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Volume 17, Number 20, October 31, 1963

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NUCLEAR SCIENCE ABSTRACTS

GENERAL AND MISCELLANEOUS

33412 (MLM-1146) MOUND LABORATORY PROGRESS REPORT FOR DECEMBER 1962. J. F. Eichelberger, G. R. Grove, L. V. Jones, and E. A. Rembold (Mound Lab., Miamisburg, Ohio). Dec. 31, 1962. Contract AT(33-1)-Gen-53. 24p.

The average molecular weights of four diallyl phthalate polymer samples extruded from the experimental rheometer were redetermined using the vapor phase osmometer. An amine curing agent is required for obtaining suitable silver-filled epoxy-bonded conductive adhesives. When the curing agent was modified with a 47% polyurethane resin, its effectiveness was hampered. Neither silver nor nickel filler impart a high electrical conductivity to Adiprene-based adhesives. Silver filler was found to perform well in Dow-Corning A-4000 adhesive. Two cascaded hot-wire columns are being used to remove heavy gaseous impurities from methane. This purified gas is being enriched in the concentric tube unit to approximately 20% carbon-13. Studies to count low-level krypton-85 in xenon are continuing. The parameters of the counting technique are being determined. The bismuth isotopes produced in bismuth irradiated for polonium production are being determined. Preliminary data indicate the presence of bismuth-207 and bismuth-210m. The light bismuth isotopes are probably produced by (n,xn) reactions bismuth-209. The separation of uranium-234 from plutonium-238 solutions was demonstrated. The bulk of the plutonium is removed by anion exchange, and the remainder is extracted from the uranium by solvent extraction techniques. About 99% of the plutonium can be removed in each thenoyltrifluoroacetone extraction. The viscosity, liquid density, and self-diffusion coefficient for lanthanum, cerium, and praseodymium were determined. The investigation of phase relationships in the plutonium-cerium-copper ternary system was continued on samples containing a high concentration of copper. These analyses indicate that complete solid solution exists between the binary compounds $CeCu_2$ and $PuCu_2$, thus forming a quasi-binary system. The study of high temperature ceramic fuel materials has continued with the homogenization and microspheroidization of binary mixtures of plutonium dioxide and zirconium dioxide. Sintering a die-pressed pellet of the mixed powders for one hour at 1450°C was not sufficient to completely react the constituents. Complete homogenization was obtained when the pellet was melted in the plasma flame. In addition to the plutonium dioxide-zirconium dioxide microspheres, pure beryllium oxide microspheres were produced in the plasma torch. The electronic distribution functions for the 10% by weight PuO_2 dissolved in a silicate glass were determined. The plutonium-oxygen interaction at about 2.2A is less than the plutonium-oxygen distance for the 5% PuO_2. The decrease in the interionic distance is indicative of a stronger plutonium-oxygen association for the more concentrated composition. Potassium plutonium sulfate is being evaluated as a reagent to quantitatively separate plutonium from aqueous solutions. The compound containing two waters of hydration was prepared for thermogravimetric studies using analytically pure plutonium-239. Because of the stability of this compound, it is being evaluated as a calorimetric standard for plutonium-238. (auth)

33413 (NP-12967) RESEARCH IN PROGRESS DURING CALENDAR YEAR 1962 UNDER THE AUSPICES OF THE U. S. ARMY RESEARCH OFFICE (DURHAM). (Army Research Office, Durham, N. C.). 274p.

The annual report of the U. S. Army Research Office, Durham, North Carolina, contains information pertaining to chemistry, physics, mathematics, engineering, metallurgy, and ceramics. The following indexes are included: materials oriented proposal numbers, proposal numbers, proposal numbers which terminated during 1962, contract numbers, grant numbers, primary scientific liaison and scientific cognizance participants with proposal numbers, contractors, and grantees with proposal numbers, chief investigators with proposal numbers, and subject index with proposal numbers. (N.W.R.)

33414 (NP-13008) ATOMIC ENERGY BOARD SIXTH ANNUAL REPORT, 1962. (Union of South Africa. Atomic Energy Board, Pretoria). 42p.

The development and expansion of activities of the Atomic Energy Board of South Africa are discussed. Topics covered include: uranium and nuclear materials production, geology, extraction metallurgy, reactor engineering, physical metallurgy, application and protection aspects of radiation and radioisotopes, chemistry, physics, medicine and biology, agriculture, auxiliary services, finances, administration, staff, list of publications, liaison and information services, and research planning. (N.W.R.)

33415 (TID-3043(Rev.2) (Suppl.1)) BIBLIOGRAPHIES OF INTEREST TO THE ATOMIC ENERGY PROGRAM. Richard J. Smith, Naomi K. Smelcer, and Hugh E. Voress, comps. (Division of Technical Information Extension, AEC), Mar. 1963. 100p.

This supplement contains 554 references to bibliographies and literature surveys on various aspects of atomic energy

and allied subjects identified by the Division of Technical Inform. .on Extension, USAEC. References are also cited to bibliographies published in the open literature. All references are arranged alphabetically by the issuing agency. Subject, author, and report number and availability indexes are provided. (auth)

33416 (TID-3715) INFORMAL LISTING OF BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE. BIBLIOGRAPHIES ISSUED OR IN PROGRESS DURING THE PERIOD, DECEMBER 1962–JANUARY 1963. (Division of Technical Information Extension, AEC). 26p.

A total of 133 bibliographies issued or in preparation are listed according to agency. Subject and author indexes are given. (D.L.C.)

33417 (TID-7660) AEC AND CONTRACTOR NUCLEAR MATERIALS MANAGEMENT SYMPOSIUM, OCTOBER 3-5, 1962. (Argonne National Lab., Ill.). Contract W-31-109-eng-38.

Twenty-one papers presented at the Eighth Annual AEC and Contractor Nuclear Materials Management Symposium are given. Separate abstracts were prepared for 18 papers. Three papers were previously abstracted for NSA. (M.C.G.)

33418 (TID-7660(p.1-5)) ADMINISTRATION AND MAINTENANCE OF A FACTOR ASSAY PROGRAM FOR SS MATERIALS. A. R. Diehl and B. Gessiness (National Lead Co. of Ohio, Cincinnati).

A factor assay program to monitor the accountability of both normal and slightly enriched SS materials processed at the FMPC (Feed Materials Production Center) are discussed. The techniques by which this program is administered and maintained are described. Methods of evaluation for materials that are not readily amenable to sampling and analysis are also described. (auth)

33419 (TID-7660(p.6-19)) ACCOUNTABILITY AND CRITICALITY CONTROL OF A BATCH-TYPE URANIUM DIOXIDE FUEL PROCESS WITH SEVERAL UNKNOWNS. W. W. Wachtl (Martin Co. Nuclear Div., Baltimore).

Accountability control of uranium dioxide fuel process as influenced by criticality considerations is considered. The process is the fabrication of spherical particles from natural UO_2 powder feed. The overall spheroidization process balance, the accountability plan, and error evaluation and balance limits are discussed. (M.C.G.)

33420 (TID-7660(p.20-33)) ACCOUNTABILITY PROBLEMS ASSOCIATED WITH THE EBR-II FUEL CYCLE. L. H. Berkes (Argonne National Lab., Idaho Falls, Idaho).

Fuel for the EBR-II consists of 95% U–5% fissium alloy. Fuel subassemblies are expected to remain in the reactor for 135 days. The subassembly is then moved to a storage space in the reactor primary tank for 15 days or longer before it is transferred to the Fuel Cycle Facility. In the Fuel Cycle Facility, the fuel is disassembled, refined, refabricated, and reassembled by remote methods for return to the reactor. Accountability problems met in the fuel cycle are reviewed. (M.C.G.)

33421 (TID-7660(p.34-7)) DATA PROCESSING IN NUCLEAR MATERIALS CONTROL. B. S. Lewis (Phillips Petroleum Co., Idaho Falls, Idaho).

The procedures used to effect management of SS materials, and the uses of computers in these procedures are discussed. Fuel element and fuel plate inspection, fuel element burnup application, fuel element subsidiary accounting by computers perpetual inventory control of sponsor-owned experiments using computers, and classification of inventory schedules by computers are described. (M.C.G.)

33422 (TID-7660(p.38-41)) THE IMPLEMENTATION AND APPLICATION OF INTEGRATED DATA PROCESSING TO NUCLEAR MATERIALS ACCOUNTING. A. W. De Merschman (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.).

The procedure adopted in converting the control of nuclear materials accounting from a manual operation to full machine accounting is described. The process entailed a conversion to electronic accounting machines and final changeover to IBM 1401 production by remote input. (auth)

33423 (TID-7660(p.52-4)) QUALITY CONTROL, RELIABILITY AND ASSURANCE IN SS MATERIALS FABRICATION. Fred K. White (Chicago Operations Office, AEC).

Quality control related to the processing or fabrication of special nuclear materials, including the generation of adequate, proper, and accurate process and manufacturing data, is discussed. The need of proper measurement, analytical sampling, process, and manufacturing controls is shown. (M.C.G.)

33424 (TID-7660(p.62-4)) AN ALL-PURPOSE DATA COLLECTION SYSTEM. P. N. McCreery (National Lead Co. of Ohio, Cincinnati).

Many functions within the operating facility require process data in the performance of their individual duties. A single system designed to serve the needs of all users with sufficient flexibility to allow statistical studies of operational performance is described. (auth)

33425 (TID-7660(p.65-71)) NEED FOR STANDARD NUMBERING AND CODING SYSTEMS IN THE AEC NETWORK. L. D. Hazelton (Dow Chemical Co. [Rocky Flats Plant], Denver).

The need for standard numbering and coding systems since electronic data processing equipment has superseded electric accounting machines as the principal mechanism for recording SS materials management data in several large contractor and AEC organizations is discussed. A review of numbering systems for weapon components and coding systems for inventories currently in use is presented. Benefits from standardization are reviewed as well as some ideas on how such a program could be launched. (auth)

33426 (TID-7660(p.72-90)) NONDESTRUCTIVE TESTING TECHNIQUES. Norman S. Beyer (Argonne National Lab., Ill.).

The use of gamma scintillation spectrometry for the assay of uranium reactor fuel is discussed. A technique that was developed for the analysis of thin flat fuel plates is described. A finished fuel plate is analyzed nondestructively for U^{235} content by comparison to standard uranium foils. This plate is then used as a standard plate and the other fuel plates are compared to it by detecting the 184-kev radiation emitted from them. Efforts to develop techniques for the production of color radiographs are described. (M.C.G.)

33427 (TID-7660(p.91-100)) THE IMPORTANCE OF CONTINUOUS SAMPLING AND ANALYTICAL EVALUATION IN THE PROCUREMENT OF URANIUM CONCENTRATES. F. E. McGinley and R. L. Philippone (Grand Junction Office, AEC).

With annual expenditures for domestic uranium concentrates approximating $270 million, it is important that accurate weighing, sampling, and analyzing procedures be employed. Accuracy also is required for sound SS materials management practices. Evaluation studies were made

of the weighing, sampling, and analyzing procedures. The evaluation program is discussed and its accomplishments are noted. Changes in sampling characteristics often require that different procedures be used to obtain the most accurate results. (auth)

33428 (TID-7660(p.101-7)) A PROGRAM FOR PUBLICATION OF SELECTED MEASUREMENT METHODS FOR PLUTONIUM AND URANIUM IN THE NUCLEAR FUEL CYCLE. Ralph J. Jones (Division of Nuclear Materials Management, AEC).

Measurement methods for nuclear materials are discussed. General information and selected analytical procedures are to be published. (M.C.G.)

33429 (TID-7660(p.112-19)) A CHEMICAL URANIUM BIAS CHECK PROGRAM. J. P. Highfill (New Brunswick Lab., AEC, N. J.).

A chemical uranium bias check program carried out in the reactor field is presented. It includes data pertaining to the preparation of synthetic known solutions similar in composition to the fuel element in question, as well as the analytical steps employed for the purpose of verifying the uranium content. The program is an example of cooperation between a commercial facility and government in dealing with the accountability of SS material. (auth)

33430 (TID-7660(p.120-32)) SCRAP RECOVERY PROBLEMS. (Argonne National Lab., Ill.).

Scrap recovery problems are discussed from the point of view of fabricators or generating contractors and of fuel and scrap reprocessors. Shipper-receiver differences in the uranium reprocessing program were considered. Recommendations for lessening these differences are discussed. (M.C.G.)

33431 (TID-7660(p.133-46)) COATING WASTE MEASUREMENT. W. H. Johnson, R. A. Schneider, and W. H. Zimmer (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Hanford measurements of SS materials in coating waste were of general concern. This concern stemmed primarily from difficulties encountered in the sampling and analysis of a highly radioactive, solid-liquid system. Until recently, it was felt that coating waste measurements, although inherently difficult and lacking in precision, were adequate. Measured losses were normally low and the system readily appeared to detect high losses resulting from processing difficulties. However, with changes in processing conditions, these measurements have become of increasing concern. Recent Hanford coating waste measurement studies and the development and application of an indirect measurement method which uses a fission product, Cs^{137}, as an index of the SS material content of coating waste are presented. (auth)

33432 (TID-7660(p.146-54)) BACKGROUND AND DEVELOPMENT OF THE IAEA FOUR REACTORS SAFEGUARDS PROGRAM. John F. Mahy, Jr. (Division of International Affairs, AEC).

The "Four Reactor Offer" is discussed. The development of the International Atomic Energy Agency is described. The IAEA development and application of safeguards is outlined. The placing of the EBWR, the Piqua Reactor, and the Brookhaven graphite and medical research reactors under IAEA safeguards is discussed. (M.C.G.)

33433 (TID-7660(p.155-65)) NUCLEAR MATERIALS IN TRANSIT. (Argonne National Lab., Ill.).

The prevention of criticality in shipments of special nuclear materials is discussed. Regulations for controlling shipments are reviewed. Testing of shipping containers to assure safety is considered. The strategic importance of fissionable materials is discussed as one reason for protection in transport. Education of the transportation industry in the hazards and precautions in shipping nuclear materials is described. (M.C.G.)

33434 (TID-7660(p.166-95)) USE OF CALORIMETRY IN NUCLEAR MATERIALS ACCOUNTABILITY. J. F. Eichelberger, G. R. Grove, K. C. Jordan, and M. N. Wolfe (Mound Lab., Miamisburg, Ohio).

Twin-bridge-type calorimeters and twin-bath-type calorimeters were developed to provide high degrees of accuracy, precision, and reliability. If the radioactive characteristics of a sample are known, a set of power output measurements can be interpreted in terms of the masses of the radioisotopes present. Specific applications, limitations, and general features of these types of calorimeters are discussed. (auth)

33435 (TID-7660(p.196-228)) RECENT DEVELOPMENTS IN FORECASTING AND DISTRIBUTION PROCEDURES. (Argonne National Lab., Ill.).

The preparation of forecasts of special nuclear material requirements for AEC programs is discussed. The purposes and preparation of long-range planning estimates are described. (M.C.G.)

33436 VARIOUS POSSIBILITIES FOR X-RAY CINEMATOGRAPHY. Heinz Gajewski (Siemens Reiniger Werke AG, Erlangen, Ger.). Aerztl. Forsch., 16: 225-30(May 10, 1962). (In German)

Various technical modifications of x-ray photography with electron-optical picture amplifiers are described and illustrated. With the methods and devices described, cinematography of the initial picture of an x-ray amplifier or of an x-ray television picture is possible. Practical aspects of this system are discussed, including exposure data, dosage, picture quality, choice of films, development, and projection. (H.H.D.)

33437 THE JOINT RESEARCH AND DEVELOPMENT PROGRAM QUARTERLY DIGEST. PERIOD FROM JANUARY 1 TO MARCH 31, 1963. Vol. 3, No. 1. (United States–Euratom Joint Research and Development Program). 95p. $5.00 per yr. (Euratom). (TID-19207)

A cumulative list of the EURATOM-United States contracts entered into force before March 31, 1963 is presented under the following headings: nuclear fuels, reactor materials, nuclear engineering, reactor physics, and miscellaneous. The scope of programs contracted for during the report period is outlined. Technical progress is reviewed. (M.C.G.)

33438 DYNAMICS OF MANNED LIFTING PLANETARY ENTRY. Sinclaire M. Scala, Abner C. Harrison, and Milton Rogers, eds. New York, John Wiley and Sons, 1963. 1000p. $15.00.

Thirty-five papers on planetary atmospheric models, aerodynamic plasmas, energy management, aerothermoelasticity, low speed aerodynamics, and hypervelocity flows are included. Separate abstracts were prepared for three papers. (D.C.W.)

33439 MICROWAVE DIAGNOSTICS OF ARC-HEATED PLASMAS. R. Warder, W. L. Nighan, M. Brodwin, and Ali Bulent Cambel (Northwestern Univ., Evanston, Ill.). p.185-205 of "Dynamics of Manned Lifting Planetary Entry." New York, John Wiley and Sons, 1963.

Microwave techniques (phase shift and attenuation measurements) were used to obtain the electron densities

and collision frequencies of arc-heated Ar and N plasma flow. The phase shift measurements of density at different frequencies agree quite well and, when compared to theoretical predictions, indicate non-equilibrium flow. The attenuation measurements agree qualitatively; however, the experimental collision frequencies and, hence, the d-c conductivities do not agree with presently accepted theoretical predictions. The infinite slab hypothesis, assumed in many microwave plasma studies, was shown to be satisfied. The microwave interferometer method is apparently reliable for determining electron densities of plasma flows. (auth)

33440 COMMUNICATIONS IN THE PRESENCE OF PLASMA MEDIA. M. P. Gachynski and G. G. Cloutier (RCA Victor Research Labs., Montreal). p.206-98 of "Dynamics of Manned Lifting Planetary Entry." New York, John Wiley and Sons, 1963.

Radio-frequency communication through the plasma sheath surrounding a hypervelocity space vehicle in a planetary atmosphere is examined. The basic concepts of the plasma kinetics describing the interaction of the particle constituents that determine the plasma properties are briefly reviewed, and the interaction of electromagnetic waves with plasmas is outlined. Current developments in the theory of electromagnetic wave propagation in non-uniform plasmas and in the performance of r-f sources in ionized media are presented. The effects of the plasma sheath on radio communications are assessed, and techniques for penetrating the plasma are described. 44 references. (auth)

33441 AN INDUCTIVE MHD GENERATOR FOR REENTRY. J. R. Radbill (North American Aviation Co., Downey, Calif.). p.299-325 of "Dynamics of Manned Lifting Planetary Entry." New York, John Wiley and Sons, 1963.

The extraction of electrical power by an electrodeless magnetohydrodynamic generator from the ionized shock layer on a vehicle entering a planetary atmosphere was studied. The electrical power output of an induction generator interacting with the flow outside the body is analyzed for single- and poly-phase windings. Data from hypersonic wind tunnel tests (described) on a model with a wedge geometry indicate power production. (D.C.W.)

33442 EFFECT OF THE STANFORD RESEARCH INSTITUTE STUDY AND OF PRIVATE OWNERSHIP UPON NUCLEAR MATERIALS MANAGEMENT. Douglas E. George (Div. of Nuclear Materials Management, AEC, Washington, D. C.). 28p. (CONF-80-3)

From Inst. of Nuclear Materials Management Meeting, Buffalo, June 1963.

The development of the nuclear materials management program of the AEC from 1946 to the present is discussed. Emphasis is placed on the various phases of policy, from Government-owned, contractor-operated plants with cost-plus-fixed-fee contracts to privately-owned plants that have full responsibility for losses of special nuclear materials. The effects of private ownership of the special nuclear materials on the AEC program are postulated, and the significance of doing a job under license is compared to that of doing the job as an SS Station. (auth)

BIOLOGY AND MEDICINE

General and Miscellaneous

Refer also to abstracts 35209, 35210, and 35211.

33443 (ANL-6723) BIOLOGICAL AND MEDICAL RESEARCH DIVISION SEMIANNUAL REPORT, JANUARY THROUGH JUNE 1962. (Argonne National Lab., Ill.). May 1963. Contract W-31-109-eng-38. 261p.

Separate abstracts were prepared for 35 sections of this report. Six sections were abstracted previously and have appeared in NSA. (C.H.)

33444 (ANL-6723(p.5-9)) EARLY ALTERATIONS IN PLASMA PROTEINS IN THE GAMMA-IRRADIATED CHICK. Emily J. B. Christian and S. Phyllis Stearner (Argonne National Lab., Ill.).

Three-day-old chicks were exposed to whole-body γ irradiation from a 5000 C Co^{60} source. A single dose of 400, 700, or 1200 r was used with a total exposure time of 10 min in each case. Blood samples were analyzed for hematocrit values, total protein, and major protein components. Data are presented on the effects of each radiation dose on plasma protein concentrations during a 6-hr period. The relation of observed changes in plasma protein concentration to the initial lethal response is discussed. (C.H.)

33445 (ANL-6723(p.10-15)) SURVIVAL OF GUINEA PIGS GIVEN LOW DAILY GAMMA-RAY EXPOSURE–FOURTH YEAR. Progress Report. George A. Sacher, Douglas Grahn, and Robert J. Robertson (Argonne National Lab., Ill.).

Progress is reported in studies on the effects of periodic duration-of-life γ exposure at levels ranging from 1.3 to 36 r/week on guinea pigs. Data are presented on survival at 350, 700, and 1050 days. It was concluded that the mortality of periodically exposed guinea pigs arises from an injury process in a physiological system which is extremely sensitive to radiation damage, but which equilibrates recovery with injury within a comparatively few months after the beginning of exposure. There was no evidence for a nonrecovering component in the guinea pig, and it was concluded that the injury produced is a linear function of weekly dose. Similarities in the low-level radiation response of guinea pigs and rhesus monkeys are pointed out. (C.H.)

33446 (ANL-6723(p.16-27)) A NOTE ON SELF-ABSORPTION AND RECIPROCITY LAW IN RADIATION DOSIMETRY. Progress Report. Ernesto Trucco (Argonne National Lab., Ill.).

A mathematical procedure is presented for use in calculating the radiation dose within a homogeneous spherical source. Absorption effects are included. (C.H.)

33447 (ANL-6723(p.28-32)) FAST AND EPITHERMAL FLUXES IN NEUTRON RADIOBIOLOGICAL FACILITIES. Norman A. Frigerio and Donn L. Jordan (Argonne National Lab., Ill.).

Procedures are described for reducing the high degree of contamination of fast neutron fluxes in radiobiological facilities by thermal and epithermal neutrons. The use of thermal absorbers, converter plates, various shielding materials, and animal positioning is discussed. (C.H.)

33448 (ANL-6723(p.33-40)) INCIDENCE OF MAMMARY NEOPLASMS IN NEUTRON- AND GAMMA-IRRADIATED FEMALE SPRAGUE-DAWLEY RATS. Howard H. Vogel, Jr. and Don L. Jordan (Argonne National Lab., Ill.). (TID-16148; UAC-6475)

The relative effects of fission neutrons and Co^{60} γ radiation on the incidence and frequency of mammary gland neoplasms in rats were compared. Data are included on the effects of different dose rates on tumor incidence and mortality over an 800-day period. Ninety-two percent of the irradiated rats developed palpable mammary tumors. Neutron-irradiated rats had a shorter latent period and a higher tumor rate than γ-irradiated rats. (C.H.)

33449 (ANL-6723(p.41-3)) LETHALITY OF FRACTIONATED DOSES OF FISSION NEUTRONS AND Co^{60} GAMMA RAYS IN MICE. Donn L. Jordan and Howard H. Vogel, Jr. (Argonne National Lab., Ill.).

Female mice were exposed to 300 rads of Co^{60} γ radiation or to 60 rads of fission neutrons each week for 13 weeks. The total weekly dose was delivered in 1, 3, or 6 equal fractions for each radiation during 10-min to 5-hr exposure times. Data are presented on mortality during 100 days after initial irradiation. (C.H.)

33450 (ANL-6723(p.44-9)) THYMIC TUMOR INCIDENCE AND LONGEVITY IN FEMALE MICE IRRADIATED WITH FISSION NEUTRONS OR Co^{60} γ-RAYS. Howard H. Vogel, Jr. and Donn L. Jordan (Argonne National Lab., Ill.).

Eighty percent of a group of young female mice exposed to either 100 rads of fission neutrons or 200 rads γ radiation, delivered at 4 different dose rates over a 21-day period, developed thymic tumors toward the end of the life span. Data on longevity and tumor incidence are presented for each radiation dose. (C.H.)

33451 (ANL-6723(p.50-2)) DISEASES OF LABORATORY ANIMALS. Progress Report. Robert J. Flynn and Isabel L. Greco (Argonne National Lab., Ill.).

A study on the susceptibility of hamsters to ectromelia virus led to the conclusion that Syrian hamsters are almost completely refractive to this virus and could not function as natural hosts. (C.H.)

33452 (ANL-6723(p.61-2)) COMPARATIVE ANALYSIS OF NEUTROPHIL KINETICS IN X-IRRADIATED DOG AND MONKEY. Mary A. Maloney, Harvey M. Patt, and Charlotte L. Weber (Argonne National Lab., Ill.).

No difference was observed between monkeys and dogs in the initial labeling of proliferating blood cells after the injection of tritiated thymidine. Response of neutrophils to whole-body x irradiation was also similar in dogs and monkeys. (C.H.)

33453 (ANL-6723(p.63-4)) EFFECT OF AGE AND RADIATION ON THE LENS OF THE EYE IN THE MOUSE. Robert L. Straube (Argonne National Lab., Ill.).

The physiological effects of aging and chronic somatic effects of ionizing radiation were compared in the eye lens of mice. It was shown that the rate at which the eye lens of mice normally change with age was unaltered by whole-body x irradiation despite the development of pathological changes incident to cataract formation. (C.H.)

33454 (ANL-6723(p.65-6)) MONTE CARLO CALCULATIONS FOR THE STOCHASTIC THEORY OF MORTALITY. George A. Sacher and Ernesto Trucco (Argonne National Lab., Ill.).

33455 (ANL-6723(p.67-72)) COMPARATIVE KINETICS OF ACUTE RADIATION LETHALITY. S. Phyllis Stearner, Sylvanus A. Tyler, and Margaret H. Sanderson (Argonne National Lab., Ill.).

The kinetics of acute radiation lethality were compared in the mouse, chick, parakeet, and pigeon after exposure to Co^{60} γ radiation protracted over single continuous periods ranging from 5 min to 24 hr. A striking similarity in response was observed. (C.H.)

33456 (ANL-6723(p.73-81)) A MODEL OF THE KINETICS OF INJURY PROCESSES ASSOCIATED WITH ACUTE LETHALITY IN THE GAMMA-IRRADIATED MOUSE. Sylvanus A. Tyler and S. Phyllis Stearner (Argonne National Lab., Ill.). (TID-16155; UAC-6458)

A kinetic model of injury accumulation is presented that describes the course of mortality for the 30-day lethal range after a single, protracted exposure of mice to Co^{60} γ radiation. (C.H.)

33457 (ANL-6723(p.100-37)) TOXICITY AND METABOLISM OF RADIONUCLIDES. III. SEMIANNUAL REPORT FOR PERIOD ENDING MAY 31, 1962. Progress Report. William P. Norris, Louise S. Lombard, Carl E. Rehfeld, Thomas W. Speckman, and Herman M. Slatis (Argonne National Lab., Ill.).

Results are reported from a study of the metabolism and toxic effects of Ce^{144} and Cs^{137} in dogs. Data are included from a study of the incidence of periodontal disease in beagles. (C.H.)

33458 (ANL-6723(p.138-9)) ABSENCE OF REPAIR OF MUTATIONAL DAMAGE IN CONTINUOUS CULTURES. Herbert E. Kubitschek and Harold E. Bendigkeit (Argonne National Lab., Ill.).

The effects of glucose and tryptophan on the induction of mutants resistant to bacteriophage in Escherichia coli were studied after exposure to caffeine and ultraviolet radiation. It was concluded that the responses were the result of different rates of induction of mutation and not of repair of latent mutational damage in the cultures. (C.H.)

33459 (ANL-6723(p.140-1)) THE STUDY OF NORMAL VARIATION. II. OBSERVATIONS ON THE INHERITANCE OF HAIR ON THE PINNA OF THE EAR. Herman M. Slatis (Argonne National Lab., Ill.).

Evidence in favor of the theory that the gene for hair on the pinna of the ear of man is transmitted on the Y chromosome is discussed. (C.H.)

33460 (ANL-6723(p.142-3)) STROPHANTHIN AND ISONICOTINIC ACID HYDRAZIDE AS POSSIBLE RADIATION PROTECTORS. Robert N. Feinstein and Marilyn Coulon (Argonne National Lab., Ill.).

No significant radioprotective action was observed for strophanthin or isonicotinic acid hydrazide in lethally irradiated mice. (C.H.)

33461 (ANL-6723(p.144-5)) PLUTONIUM REMOVAL, TUMOR INCIDENCE STUDIES. [PART] III. Progress Report. Marcia W. Rosenthal, Joan Fried Markley, and Arthur Lindenbaum (Argonne National Lab., Ill.).

Bone tumor incidence was correlated with the skeletal content of Pu following administration of a colloidal form of Pu to mice, with and without delayed therapy with diethylenetriaminepentaacetic acid (DTPA). The index of radiation effects was the proportion of mice that had at least one malignant bone tumor at death. DTPA treatment given for 12 days removed 43.2% of the Pu deposited in bone and reduced the fraction of mice with bone tumors by 42.5% at the time the last untreated mouse died at 515 days. (C.H.)

33462 (ANL-6723(p.146-8)) PLUTONIUM REMOVAL. V. ULTRAFILTERABILITY AND DISAPPEARANCE OF PLUTONIUM FROM PLASMA AS A FUNCTION OF DTPA TREATMENT AND OF THE PHYSICAL STATE OF THE PLUTONIUM. Progress Report. Arthur Lindenbaum, Joan Fried Markley, Marcia W. Rosenthal, William M. Westfall, and Elizabeth S. Moretti (Argonne National Lab., Ill.).

The early behavior of polymeric and monomeric forms of Pu solutions was compared after injection into rats with respect to their ultrafilterability and rate of disappearance in the blood, both in the presence and absence of diethylenetriaminepentaacetic acid (DTPA). It was concluded that the observed accelerated rate of disappearance of the polymeric form of Pu was a result of reticuloendothelial removal of colloidal particles. The effects of DTPA therapy were more pronounced on Pu injected in monomeric form. (C.H.)

33463 (ANL-6723(p.149-52)) METABOLISM OF METHIONINE AND S-ADENOSYLMETHIONINE IN NEUROSPORA. Lila Abrahamson (Argonne National Lab., Ill.).

The metabolism of methionine and S-adenosylmethionine (S-AM) was studied in Neurospora crassa, strains 5256a and 38706, by determining the amount of S-AM accumulated in the presence of varying concentrations of L-methionine and other compounds in the growth medium. Strain 5256a is a prototroph that can grow in medium lacking methionine, while strain 38706 is a methionineless auxotroph that cannot convert homocysteine to methionine and requires methionine for growth. (auth)

33464 (ANL-6723(p.153-4)) BETA-SCINTILLATION COUNTING OF RADIOACTIVE TRACERS ON FILTER PAPER. Walter E. Kisieleski and Donald Logsdon (Argonne National Lab., Ill.).

A technique for the scintillation counting of weak β-emitters on wet filter paper directly on the surface of a photomultiplier tube was tested. Good detection efficiency was found for C^{14}, Ca^{45}, and P^{32}. The method also gave good results for the counting of labeled cells or microorganisms on millipore filters. (C.H.)

33465 (ANL-6723(p.165-73)) BIOSYNTHESIS OF METHIONINE FROM HOMOCYSTEINE AND SULFONIUM DERIVATIVES IN ESCHERICHIA COLI. Morris Pfeffer and Stanley K. Shapiro (Argonne National Lab., Ill.).

Cell-free extracts of E. coli (Texas) and E. coli (Texas) M, prepared in a 10-kc Raytheon sonic oscillator, were assayed for S-methylmethionine– and S-adenosylmethionine–homocysteine methyl-transferase activity using C^{14}-labeled sulfonium compounds, and found to possess the enzyme. Paper chromatograms of reaction mixtures were scanned with a recording scanner to confirm the fact that methionine was the labeled reaction product being assayed. These determinations led to the observation that S-methylmethionine is a more active methyl donor than S-adenosylmethionine. The lower activity of S-adenosylmethionine as a methyl donor was paralleled by its lower growth-promoting activity for intact E. coli (Texas) M, as compared with S-methylmethionine. (C.H.)

33466 (ANL-6723(p.174-7)) PHOSPHATE METABOLISM AND EFFECT OF THIOPHOSPHATE IN CHLORELLA. Takuya R. Sato (Argonne National Lab., Ill.).

The effects on plant and animal tissue preparations of various phosphates, in particular those containing P-O-P, P-P, and P-S bonds, were studied. Early experiments indicated that the effects of thiophosphate were of special interest. Data are reported on the effects of phosphate com-

pounds on growth and respiration in algae, and the effects of thiophosphate on a mammalian enzyme system, i.e., the ATP–inorganic phosphate exchange reaction. Little is known about the effects of replacing orthophosphate by other inorganic phosphates. By the use of algae, which store large amounts of phosphate as polyphosphate, it was possible to determine whether compounds such as diphosphite, hypophosphate, and thiophosphate inhibit competitively the utilization of orthophosphate, alter cellular function by some other mechanism, or can be utilized, converted to orthophosphate, and stored in the cell. Results are presented from studies of phosphate metabolism in normal Chlorella and isolated mitochondria from rat liver. (C.H.)

33467 (ANL-6723(p.178-80)) ALKALINE HYDROLYSIS OF S-ADENOSYLMETHIONINE IN TRITIATED WATER. F. Schlenk and Julia L. Dainko (Argonne National Lab., Ill.).

Data on the alkaline hydrolysis of S-adenosylmethionine are presented that are in agreement with the mechanism suggested by Frank, et al. Transitory desaturation of the ribose and rehydration after, or concomitant with, the splitting of the glycosidic bond is indicated by the uptake of tritium into the carbohydrate part. Because of the racemization resulting from this process, the product should be termed S-pentosylmethionine rather than S-ribosylmethionine. (auth)

33468 (ANL-6723(p.181-4)) USE OF MIXTURES OF DPND ISOMERS IN ESTABLISHING REACTION MECHANISMS OF DEHYDROGENASES. John F. Thomson and Jacqueline J. Darling (Argonne National Lab., Ill.).

A procedure is described for use in establishing reaction mechanisms of dehydrogenases. (C.H.)

33469 (ANL-6723(p.185)) ELECTRON MICROSCOPY OF CENTRIFUGED AMOEBA PROTEUS. Edward W. Daniels (Argonne National Lab., Ill.).

The subcellular components within living interphase amoebae were stratified by centrifugation and fixed immediately thereafter in OsO_4, dehydrated in graded alcohols, embedded in Epon resin, sectioned, and examined with an RCA electron microscope. The strata are classified into 4 major zones and each is described. (C.H.)

33470 (ANL-6723(p.186-9)) DEVELOPMENT AS THE MEANS OF MULTIPLICATION OF ORGANELLES AND ORGANELLE SYSTEMS IN PARAMECIUM. Charles F. Ehret and Gérard de Haller (Argonne National Lab., Ill.).

Results are reported from a study of the ultrastructural changes associated with the multiplication of organelles and organelle systems at precisely selected phases of the division cycle in Paramecium. (C.H.)

33471 (ANL-6723(p.198-201)) AN AUTORADIOGRAPHIC TECHNIQUE FOR LIGHT AND ELECTRON MICROSCOPY. O. T. Minick (Argonne National Lab., Ill.).

When making autoradiographic studies with the electron microscope, it is often convenient to use the light microscope for orientation. Since preparation techniques for electron microscopy are quite different from those used in light microscopy, it is helpful to have a method that can be used for making autoradiographs for either or both light and electron microscopy. Such a method is described. Applications of the method in the preparation of autoradiographs of Tetrahymena pyriformis grown in media containing tritiated thymidine are described. (C.H.)

33472 (ANL-6723(p.203-4)) AUTORADIOGRAPHIC INVESTIGATION OF THE MITOTIC CYCLE OF EHRLICH ASCITES TUMOR CELLS IN VIVO. Renato Baserga and Walter E. Kisieleski (Argonne National Lab., Ill.).

The rates of protein synthesis during mitosis were measured in tumor-bearing mice injected with tritiated thymidine and C^{14}-leucine. Two-emulsion autoradiographs were made of the tumor cells. Grain counts in the second emulsion showed that these cells synthesize proteins at a higher rate during the period of DNA synthesis. At the end of the S phase, protein synthesis decreases progressively until it reaches a minimum during the period from meta- to telophase. (auth)

33473 (ANL-6723(p.205-7)) BIOCHEMISTRY OF GLUCOSE OXIDASE. I. METHEMOGLOBIN FORMATION AFTER GLUCOSE OXIDASE INJECTION IN MICE. Robert N. Feinstein and Marilyn Coulon (Argonne National Lab., Ill.).

The injection of sufficient glucose oxidase into mice causes methemoglobin formation, decrease of total blood pigment, appearance of pigment in plasma and urine, and death of the animal. (auth)

33474 (ANL-6723(p.208-10)) CATALASE ACTIVITY IN VARIOUS INBRED MOUSE STRAINS. Robert N. Feinstein and Marilyn Coulon (Argonne National Lab., Ill.).

The catalase activity of 19 different inbred strains of mice was investigated. The study is part of a program to develop a catalase-free animal by selective breeding. (C.H.)

33475 (ANL-6723(p.211-14)) ATTEMPTS AT REDUCTION OF ERYTHROCYTE CATALASE LEVEL. Robert N. Feinstein, Marilyn Coulon, and Elizabeth Thompson (Argonne National Lab., Ill.).

Attempts at reduction of the erythrocyte catalase level in mice failed. Various compounds of 3-amino-1,2,4-triazole (AT) and allylisopropylacetamide (AIA), with and without methylene blue and sub-lethal whole-body irradiation, were tried. (C.H.)

33476 (ANL-6723(p.215)) EFFECT OF NICOTINAMIDE ON GROWTH OF MOUSE EHRLICH ASCITES TUMOR. Robert N. Feinstein, Marilyn Coulon, and Elizabeth Thompson (Argonne National Lab., Ill.).

Nicotinamide had no effect on the growth of transplanted Ehrlich ascites tumors in mice. (C.H.)

33477 (ANL-6723(p.237-42)) UTILIZATION OF DNA AND RNA PRECURSORS AS INDICATORS OF DRUG EFFECT ON CANCER CELLS. Agnes N. Stroud, Gerald O. McDonald, Beverly R. Svoboda, and Austin M. Brues (Argonne National Lab., Ill.).

Results are reported from studies of the effects of anticancer drugs on DNA and RNA synthesis in several mouse tumor systems, using tritium-labeled thymidine and uridine. Using these labeled precursors the biochemical damage to cells resulting from 5-fluorouracil (5-FU), actinomycin D (ACTD), nitrogen mustard (HN-2), and triethylenethiophosphoramide (TSPA) was measured. These measurements were made at two different time intervals, using a single concentration or amount of each drug. In vivo and in vitro experiments were performed using two mouse tumors; the Ehrlich ascites carcinoma, and the Andervont breast carcinoma. The in vitro preparations included cell cultures, cell suspensions, and tissue slices. Results show a lack of correlation between in vitro and in vivo labeling of ascites tumor cells with thymidine, possibly because of different metabolic conditions depending on the techniques and media used. Labeling of cells in vitro continued throughout the period of exposure to the

radioactive nucleosides, in contrast to the flash labeling by an in vivo injection. Synthesis of DNA was effectively inhibited by all drugs as shown by alterations in the uptake of tritiated thymidine and uridine. (auth)

33478 (ANL-6723(p.243-51)) CHROMOSOME STUDIES OF VARIOUS STRAINS OF HUMAN TUMORS H.Ad.1 AND H.Ep.3 MAINTAINED IN RODENTS. Agnes N. Stroud, Beverly R. Svoboda, and Harold B. Haley (Argonne National Lab., Ill.).

Results are reported from chromosome studies of various strains of human tumors maintained in rodents. The chromosome smear technique was used to determine chromosome patterns and transplantation effects. (C.H.)

33479 (EUR-147.f) L'ÉVOLUTION DU POIDS DES ORGANES DU CORPS HUMAIN, DE LA NAISSANCE A L'AGE ADULTE, EN EUROPE OCCIDENTALE. Données anatomiques moyennes applicables à la détermination des niveaux admissibles de contamination, dans les problèmes de protection interne contre les radiations ionisantes. (Weight Evolution in Organs of the Human Body, from Birth up to Adult Age, in Western Europe. Mean anatomical data to be used in determining admissible contamination levels, when internal protection against ionizing radiations is concerned). Claudine Fabry (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Fontenay-aux-Roses). 1963. 110p.

Mean anatomical data are presented on the weight of organs of the human body from birth to adult age for males and females of Western Europe. The data will be used in revised estimates of the maximum permissible concentration of radioactive substances. (C.H.)

33480 (NP-13010) QUARTERLY PROGRESS REPORT NO. 48 [ON RADIOBIOLOGY]. (Chicago. Univ. Air Force Radiation Lab.). July 15, 1963. Contract AF 41(609)-1693. 129p.

Separate abstracts were prepared on 10 sections of this report. (C.H.)

33481 (NP-13010(p.1-10)) THE EFFECTS OF ORAL ADMINISTRATION OF MIXTURES OF VARIOUS SULFUR-CONTAINING COMPOUNDS ON RADIATION-INDUCED CHANGES IN ENZYME ACTIVITIES IN CERTAIN RAT TISSUES. Bernard F. Hietbrink, Marjorie Keshmiri, and Mary E. Hayward (Chicago. Univ. Air Force Radiation Lab.).

A study was conducted to determine quantitatively the radioprotective activity of orally administered mixtures of various S-containing compounds in rats. Doses of MEA ranging from 300 mg/kg to 500 mg/kg were given as mixtures with 1000 mg/kg of cysteine 30 min before 400 r of x irradiation. The mixture of 1000 mg/kg of cysteine and 500 mg/kg of MEA provided a reduction of 37% in the biological effect of radiation in the spleens but like the other mixtures tested did not substantially benefit the thymus glands and intestines. Oral administration of 1500 mg/kg of cysteine and 500 mg/kg of MEA 30 min before x ray provided marked reductions in the biological effect of 400 r in the tissues tested. This mixture was much less effective when given 15, 45, or 60 min before x radiation. Experiments undertaken to determine the protective activity of mixtures of glutathione and other S-containing compounds indicated that the mixture of 1500 mg/kg of glutathione and 500 mg/kg of MEA given orally 15 min before x radiation provided 35, 20, and 29% reductions in the biological effect of 400 r in the spleens, thymus glands, and intestines, respectively. When this treatment was given at 30, 45, or 60 min before x radiation it provided protection to the hematopoietic tissues but did not reduce the injurious effects in the intestines. Mixtures of glutathione plus AET and glutathione plus cysteine did not significantly alter the radioinduced changes in the enzyme activities of the spleen and intestine when given orally 30 min before 400 r. Results of studies to determine the influence of intraperitoneal injection of Na pentobarbital on the radioprotective activity of chemical agents given orally showed that 25 mg/kg of pentobarbital nullified the protective effect of 1000 mg/kg of cysteine in the spleen. In most instances Na pentobarbital did not significantly affect the protective activity of the mixtures in the hematopoietic tissues but reduced the beneficial effects of these agents in the intestine. (auth)

33482 (NP-13010(p.11-22)) INFLUENCE OF X-IRRADIATION ON THE DEVELOPMENT OF A THIOPHOSPHATE–OXIDIZING ENZYME SYSTEM IN THE LIVERS OF YOUNG MALE RATS. Bernard E. Hietbrink, Marjorie Keshmiri, and Kenneth P. DuBois (Chicago. Univ. Air Force Radiation Lab.).

Additional studies were undertaken to determine the radiosensitivity of the phosphorothioate-oxidizing enzyme system in the livers of young male rats. The results of experiments on the influence of partial body shielding indicated that shielding the head and testes reduced the degree of inhibition caused by 200 r of x radiation. The injection of 25 mg/kg of Na pentobarbital caused a marked stimulation in the microsome enzyme activity of the livers of normal and irradiated young male rats at 24 hr after administration. The enzyme activity tended to return toward normal in both groups after five to seven days. It is evident that the increase in enzyme activity observed in irradiated animals, which had been anesthetized with pentobarbital during x ray exposure, was due to barbiturate-induced enzyme stimulation. Measurements of the influence of x irradiation on phenobarbital-induced increases in phosphorothioate-oxidase activity showed that 200-r does not significantly affect the increase in enzyme activity caused by daily doses of 2 mg/kg of the barbiturate. Results of experiments on the influence of 200 or 400 r of x irradiation on the increase in enzyme activity caused by 5 mg/kg of phenobarbital indicated that 200 r did not influence barbiturate-induced stimulation in activity but that 400 r reduced the degree of enzyme increase that was observed after six or eight daily injections. Injections of 75 mg/kg/day of Na phenobarbital caused a twofold and a fourfold increase in the enzyme activity of adult female and young male rats, respectively. Administration of 600 r to adult females and 400 r to young male rats one day before injections of phenobarbital were begun did not reduce the stimulatory effect of this drug. (auth)

33483 (NP-13010(p.23-9)) FURTHER STUDIES ON THE INFLUENCE OF X-IRRADIATION ON THE REDUCTASE ACTIVITY OF THE LIVERS OF RATS. Kenneth P. DuBois and Bernard E. Hietbrink (Chicago. Univ. Air Force Radiation Lab.).

The reductase activity of the livers of normal, immature, male rats ranging in age from 14 to 42 days was measured. The results of these assays demonstrated that the enzyme activity was about $\frac{1}{3}$ of the adult level at 14 days and it reached the adult level by 26 days. Exposure of 14-day-old rats to 400 r of x radiation did not inhibit the rate of increase of the liver reductase activity to the normal adult level. The reductase activity of regenerating liver was found to be near the normal level at one day after partial hepatectomy. The absence of an appreciable decrease in the enzyme activity of the liver makes the

hepatectomized rat unsuitable for studying the influence of radiation on the development of this enzyme. (auth)

33484 (NP-13010(p.30-48)) THE INFLUENCE OF VARIOUS CHEMICAL COMPOUNDS ON RADIATION LETHALITY IN MICE. V. Plzak, M. Root, and J. Doull (Chicago. Univ. Air Force Radiation Lab.).

Thirty-six new compounds were evaluated for protective activity against radiation lethality in CF_1 male mice. Of these, 13 were significantly protective in that they permitted 20% or more of the animals to survive an otherwise lethal dose of whole-body x radiation. Nine additional compounds protected 10% of the mice for 30 days or more. The best protection was obtained with GE-16 where 80 and 40%, respectively, of the mice pretreated with two dosage levels of this compound survived for 30 days after the radiation exposure. GE-23 protected 60% at one dosage level and 10% at the other dose employed, whereas GE-17 allowed 40 and 50% of the animals to live for 30 days after x irradiation, ST-16, another compound for which a release has not yet been obtained, protected 50 and 40% of the mice at the two dosage levels. WI-1, monothiosuccinimide, was equally protective at both of the doses used, protecting 40% of the animals from lethality. The two compounds which protected 30% of the mice were GE-26 and EK-8413 (2-aminoethanethiolsulfuric acid). The remaining six significant protectors permitted survival of 20% of the mice. They included: EK-356, hydroquinone; AN-9, p-dimethoxybenzene; AN-10, disodium methanearsonate; GE-13, 1,2-diphenyl-4(2'-phenylsulfinethyl)-3,5-pyrazolidinedione; GE-25; and GE-19. Ten per cent of the mice treated with the following compounds also survived for 30 days after irradiation: EK-206, m-phenylenediamine dihydrochloride; AN-7, p-methoxyphenol; AN-8, tetramethylammonium chloride; GE-14, 3,5-dioxo-1-phenyl-2-p-hydroxyphenyl-4-n-butylpyrazolidene; GE-15, 3,5-dioxo-1,2-diphenyl-4-n-butylpyrazolidene; GE-20; GE-21; GE-22; and ST-15. (auth)

33485 (NP-13010(p.49-54)) THE EFFECT OF POST-IRRADIATION ADMINISTRATION OF SODIUM SULFITE AND OTHER COMPOUNDS ON RADIATION LETHALITY IN FEMALE MICE. J. Dilley and J. Doull (Chicago. Univ. Air Force Radiation Lab.).

The post-irradiation administration of Na_2SO_3 at a dosage level equivalent to about one-third of the LD_{50} for this agent was shown to increase significantly the number of animals (CF_1 female mice) surviving at 30 days after 600 r of whole-body x irradiation. Comparison of the therapeutic effectiveness of Na_2SO_3 with 2-imino-thiazolidine-4-carboxylic acid indicated that on a molar basis, but not on a mg/kg basis, Na_2SO_3 is somewhat more effective in preventing radiation lethality in mice. The therapeutic effect of Na_2SO_3 in x irradiated mice can be eliminated by the simultaneous administration of cystine. (auth)

33486 (NP-13010(p.55-65)) METABOLISM AND EXCRETION OF p-AMINOPROPIOPHENONE IN MICE. J. Doull and V. Plzak (Chicago. Univ. Air Force Radiation Lab.).

A standard method for the detection of free and bound sulfonamides was used to investigate the excretion of p-aminopropiophenone (PAPP) and acetyl PAPP in the urine of CF_1 female mice. This method, which depends on the diazotization of the free amino group and subsequent coupling with an ethylenediamine derivative, was found to be suitable for the measurement of the phenone derivatives in the blood and urine of mice at concentrations of 1 to 25 gamma per ml. Both PAPP and acetyl PAPP are excreted rapidly in the urine of CF_1 female mice when given by intraperitoneal administration, although higher dosage levels which depress the animals delay the excretion by this route. With low doses (10 mg/kg intraperitoneally) of these agents about 50% of the administered agent was recovered in the free or acetylated form in the urine. Lower recoveries were obtained when the dosage level was increased. During the early period (0 to 6 hr) after the administration of either PAPP or acetyl PAPP, most of the agent in the urine is present in the acetylated form whereas the reverse situation occurs at later intervals (12 to 24 hr). Acetyl PAPP is excreted in the urine of CF_1 female mice as free PAPP as well as in the acetylated form indicating that this agent undergoes a partial in vivo de-acetylation prior to excretion. A methemoglobin-forming substance was detected in the urine of CF_1 female mice given either PAPP or acetyl PAPP. This substance appeared to be relatively stable when kept cold. Preliminary studies were carried out to determine whether the urinary concentration of this material is related to the urinary concentration of either the free or bound forms of PAPP. (auth)

33487 (NP-13010(p.66-73)) CURRENT STATUS OF THE CHRONIC LOW LEVEL FAST NEUTRON IRRADIATION PROGRAM. A. Sandberg and J. Doull (Chicago. Univ. Air Force Radiation Lab.).

Mortality data obtained during the first 54 weeks of a duration-of-life chronic fast neutron irradiation study are presented and compared with previous studies in this laboratory. The median survival time of the mice exposed to 3.18 rad/day was 32 weeks, and a life span shortening of 39.6% was calculated on the basis of survival data for CF_1 female mice from a previous study. The slope of the log probit curve for those mice that received 3.18 rad/day is approximately the same as that for the group of mice that received 1.66 rad/day indicating that, at this dose, the processes leading to death are initiated earlier but may proceed at approximately the same rate as those in groups that received 1.66 rad/day. (auth)

33488 (NP-13010(p.74-80)) STUDIES ON THE TOXICITY OF RARE EARTH COMPOUNDS AND THEIR INFLUENCE ON RADIATION LETHALITY. David W. Bruce and Kenneth P. DuBois (Chicago. Univ. Air Force Radiation Lab.).

Intravenous administration of 4, 8, and 12 mg/kg of Pr as the nitrate salt resulted in mortality of 40, 50, and 20%, respectively, of adult castrated rats that were injected 15 days after castration and observed for a period of 30 days. The intravenous administration of 8 mg/kg of Pr as the nitrate salt caused a decrease in blood glucose in both intact and castrated male rats. The average per cent decrease from control values was 13 and 23% at 24 hr, 34 and 31% at 48 hr, and 41 and 31% at 72 hr for intact and castrated males, respectively. The administration of 2 mg/kg of Pr at pH 3.5 and 5.5 resulted in a 51% decrease in the endogenous respiration of liver slices from female rats 48 hr after administration. When 2 mg/kg of Pr was given as a colloidal suspension at pH 7.5 the QO_2 values obtained did not differ significantly from control values. (auth)

33489 (NP-13010(p.81-106)) RADIATION PATHOLOGY OF CHEMICALLY PROTECTED MICE SERIALLY SACRIFICED FOLLOWING PROTON OR X-IRRADIATION. D. Vesselinovitch, F. Fitch, J. Meskauskas, D. G. Oldfield, V. Plzak, and J. Doull (Chicago. Univ. Air Force Radiation Lab.).

The radioinduced decrease and subsequent recovery of spleen weight is similar in proton- and x-irradiated mice; some protection against splenic weight loss by MEA was observable for both types of radiation. Atrophy of the lymphoid tissue in the spleen, thymus, and lymph nodes was observed in mice exposed to 440-Mev proton or 250-Kvp x radiation. In proton-irradiated mice, MEA decreased the severity of this effect in the spleen while in x-irradiated mice MEA did not produce this effect. Enhanced recovery of hematopoietic cells was observed in MEA-treated mice, granulocytic elements being first to recover in proton-irradiated mice while erythroblastic elements were the first to appear in x irradiated mice. Bone marrow hypocellularity, as well as gelatinous marrow, was less frequently observed in MEA-treated animals. Enhanced hematopoietic recovery of the bone marrow was predominantly myeloblastic regardless of the type of radiation used. Focal aspermatogenesis produced by proton and x irradiation appeared to be diminished by pretreatment with MEA. Lesions similar to peliosis hepatis in humans were observed in proton-irradiated mice with or without MEA treatment. Similar lesions were observed in one of the x irradiated mice. Subdural hemorrhages and hemorrhages of the gray matter in the cerebrum and the cerebellum were present in a few mice exposed to high-energy protons, and in an x irradiated mouse. (auth)

33490 (NP-13010(p.107-26)) THE TIME-COURSE OF SURVIVAL IN PROTON- OR X-IRRADIATED MICE PRETREATED WITH CHEMICAL PROTECTORS. D. G. Oldfield, J. Doull, V. Plzak, A. Hasegawa, and A. Sandberg (Chicago. Univ. Air Force Radiation Lab.).

Survival vs time in CF_1 male mice whole-body irradiated by high-energy (440-Mev) protons or by medium energy (250 Kvp) x rays with and without pre-irradiation treatment with 2-mercaptoethylamine hydrochloride or p-aminopropiophenone is reported. General properties of the survival curves and differences between curves for replicated runs are described. The analytical basis for a detailed comparison of the entire course of survival curves is discussed. (auth)

33491 P^{32} TREATMENT OF POLYCYTHEMIA VERA. Thilde Kellermann and Hans Werner Pabst (Universitat, Munich). Aerztl. Forsch., 17: 251-7(May 10, 1963).

Phosphorus-32 treatment of 30 patients over a 12-yr period is related and discussed with respect to dosage, clinical and histologic effects, and complications. The initial dose used was 0.1 mc P^{32} per kg body wt. This usually resulted in a remission of erythrocyte count for 16 months. No close correlation was noted between the duration of remission and dose, nor did radioresistance develop after repeated P^{32} doses. Remissions after three to four treatments generally exceeded the first in length. Maximum depression of red cell count was reached 4.5 months after treatment, and the mean post-treatment count was 4.05×10^6. Both leukocyte and platelet counts fell to below 50% of initial values; however, no serious side-effects were generally observed. Bone marrow biopsies, which initially showed hyperplasia of erythroid elements, indicated that P^{32} probably does not directly inhibit cellular proliferation but, rather, acts on marrow blood vessels, and eventually causes fibrosis of marrow space. (TCO)

33492 STUDIES ON IMMUNITY TO UNCINARIA STENOCEPHALA INFECTION IN THE DOG—DOUBLE VACCINATION WITH IRRADIATED LARVAE. C. Dow, W. F. H. Jarrett, F. W. Jennings, W. I. M. McIntyre, and W. Mulligan (Univ. of Glasgow). Am. J. Vet. Res., 22: 352-4(May 1961).

It was shown previously that a high degree of immunity to infection with the European hookworm U. stenocephala can be induced by oral administration of irradiated infective larvae. The effect of administering two doses of irradiated 3rd-stage hookworm larvae to pups before subjecting them to challenge infection with normal larvae was tested and the effect of low roentgen doses on the larvae was investigated. Observations that irradiated larvae produce a high degree of resistance to reinfection were verified. A significantly greater number of worms was recovered from the pups given larvae irradiated with 20,000 r than from those given larvae irradiated with 40,000 r. The fecal egg output of pups in the former group was also higher, and a greater number of larvae reached maturity at this dose level. Comparison with the previous experiments suggests that double vaccination produces a higher degree of resistance to reinfection than does single vaccination. In the present experiment, the doses used were insufficient to produce attenuation of all the larvae; some reached maturity and laid viable eggs. If this method were applied in the field, a higher degree of partial inactivation would have to be obtained. (BBB)

33493 PLASTIC RECONSTRUCTION OF THE PHARYNX AFTER LARYNGOPHARYNGECTOMY IN SEVERE RADIATION INJURY TO THE SKIN OF THE NECK. A. Rethi. Arch. Ohren., Nasen., Kehlkopfheilk., 180: 505-6(1962). (In German)

33494 THE AMOUNT OF Sr^{90} IN THE BONES OF PEOPLE WHO HAVE DIED OF LEUKEMIAS. J. Aleksandrowicz, L. Tutaj, M. Wazewska-Czyzewska, and B. Marchand (III Clinic of Internal Diseases, Academy of Medicine, Krakow and Universitat, Freiburg i.B.). Blood, 22: 346-50 (Sept. 1963).

The amounts of Sr^{90} in the bones of persons who died of leukemias and in the bones of those deceased from causes other than tumors or hemocytopathic diseases were compared. The first group shows an abnormally low level of Sr^{90}. It was concluded that disturbed calcium metabolism in leukemia patients caused the low Sr^{90} values. (C.H.)

33495 EFFECT OF ASCORBIC ACID IN VIVO ON LABELING OF RED CELLS BY RADIOACTIVE SODIUM CHROMATE. J. William Poppell, Margaret E. Hood, and Jerome J. DeCosse (Sloan-Kettering Inst. and Memorial Hospital, New York). Blood, 22: 351-6(Sept. 1963).

Evidence is presented that the reducing action of physiologic concentrations of blood ascorbic acid in vivo can modify radioactive Na chromate tagging of red cells, and that blood ascorbic acid concentrations have a significant role in the inability to tag 100% of red cells with radioactive Na chromate. The results indicate that a higher per cent tag may be obtained if oral and parenteral ascorbic acid therapy are discontinued before withdrawing blood to be used for red cell mass or survival studies. The response of blood ascorbic acid levels to administration of intravenous ascorbic acid has been used as a measure of ascorbic acid deficiency. In 52 patients tested by varying amounts of intravenous ascorbic acid, the presence or absence of pre-test ascorbic acid loading did not affect the degree of change in vitamin C levels at the end of the infusion or 1 hr later, although five patients had baseline blood concentrations of ascorbic acid that were below the normal range. (C.H.)

33496 PREPARATION OF CARBON-14 LABELED SUBSTANCES BY BIOSYNTHETIC PROCESSES. I.

APPARATUS FOR BIOSYNTHESIS OF LABELED SACCHARIDES. II. ISOLATION OF CARBON-14 LABELED PRODUCTS OF PHOTOSYNTHESIS FROM CHLORELLA VULGARIS. III. PARTITION OF CARBON-14 LABELED AMINO ACIDS FROM PROTEIN HYDROLYSATE OF. J. Lisbster, M. Dobinsove, J. Mopoldove, J. Kosel, and J. Ekl (Inst. of Biology, Academy of Sciences, Prague). Collection Czech. Chem. Commun., 26: 1582-90; 1694-9; 1700-07(1961). (In German)

Apparatus and experimental conditions for CO_2^{14} incorporation into plant saccharides are described. Eighty % of the radioactivity was found in glucose, fructose, and sucrose under these conditions. The isolation of labeled substances having high specific activity is also described. C^{14}-labeled substances were produced by C. vulgaris during photosynthetic reactions. Seventy-five % of the CO_2^{14} radioactivity was incorporated into proteins and 10% into lipids. Partition of C^{14}-labeled amino acids, from a protein hydrolysate of Eblorella, on a Dowex-50 column, is also described. (Atomdokumentation, 4: No. 14, Nov. 1962.)

33497 REGIONAL PULMONARY FUNCTION STUDIED WITH XENON^{133} IN PATIENTS WITH BRONCHIAL ASTHMA. L. G. Bentivoglio, F. Beerel, A. C. Bryan, P. B. Stewart, B. Rose, and D. V. Bates (McGill Univ., Montreal). J. Clin. Invest., 42: 1193-1200(Aug. 1963).

Twelve patients with bronchial asthma in spontaneous or medically maintained remission were studied by routine pulmonary function tests and the Xe^{133} technique. In spite of a somewhat wider scatter of data, the Xe^{133} static distribution indexes for ventilation and perfusion in asthmatic subjects showed, in general, close agreement with the previously reported findings in normal subjects. In some cases, slight zonal abnormalities of the ventilation indexes after a single tidal breath indicated minor local reductions of ventilation. The perfusion distribution appeared to be normal. A development of the Xe^{133} technique is described whereby the time course of gas distribution during equilibration with a closed circuit can be followed over six lung zones simultaneously. In six of the twelve patients studied, the residual impairment of gas distribution was found to follow a zonal rather than a diffuse uniform pattern. The patients showing this defect had a significantly greater degree of impairment of forced expiratory volume, maximal mid-expiratory flow rate, and helium mixing efficiency than did those not showing this abnormality. These findings indicate that the residual ventilatory impairment in patients with bronchial asthma in remission must be seen as a zonal or possibly lobar phenomenon. Such regional ventilatory impairment does not seem to be accompanied by a corresponding reduction in perfusion. (auth)

33498 VISUALIZATION OF THE LIVER BY SCANNING WITH Mo^{99} (MOLYBDATE) AS TRACER. Leif B. Sorensen and Maureen Archambault (Univ. of Chicago). J. Lab. Clin. Med., 62: 330-40(Aug. 1963).

A technique for scanning of the liver with radiomolybdate as tracer has been developed. The method is based on the demonstration that intravenously injected carrier-free Mo^{99} is selectively and efficiently concentrated in the polygonal cells of the liver. The 0.140-Mev gamma radiation of the daughter Tc^{99m} is particularly suitable for scanning purposes. Good visualization is obtained when scans are done 24 hr after injection of 40 μC of Mo^{99}. Tumors, abscesses, and other space-occupying lesions are visible as defects. Decreased hepatic uptake of Mo^{99} is observed in diffuse hepatocellular diseases. This tracer has certain advantages over colloidal Au^{198} and I^{131}-labeled rose bengal. (auth)

33499 SYNTHESIS OF ADENOSINE TRIPHOSPHATE UNDER POSSIBLE PRIMITIVE EARTH CONDITIONS. Cyril Ponnamperuma, Carl Sagan, and Ruth Mariner (Ames Research Center, Moffett Field, Calif. and Stanford Univ., Palo Alto, Calif.). Nature, 199: 222-6(July 20, 1963).

In view of the fact that several fundamental coenzymes of intermediate metabolism and plant photosynthesis are nucleoside phosphates, and as all of these molecules contain purines and pyrimidines that have strong ultraviolet absorption maxima near 2600 A°, the possibility arises that the absorption of ultraviolet photons by purines and pyrimidines provided the bond energy for the synthesis of nucleoside phosphates in primitive tissues. To test the hypothesis, such syntheses were attempted under laboratory conditions. Labeled adenine, adenosine, and adenylic acid were sealed in aqueous solutions in Vycor tubes with approximately stoichiometric quantities of ribose, phosphoric acid, or polyphosphate ester. The solutions were irradiated by four General Electric ultraviolet germicidal lamps. During a one hour irradiation, the samples absorbed a total of ~ 10^9 ergs. Reaction products were analyzed by paper chromatography, autoradiography, and ultraviolet absorption. Positions of the carriers were detected by shadowgrams. Coincidence both in position and in shape between the carriers on the shadowgrams and the radioactivity on the autoradiograph were chromatographic bases for identification. Ultraviolet excitation of adenine accounts for the synthesis of adenosine, but participation of phosphorus compounds in the reaction is obscure. It was concluded that ultraviolet irradiation of solutions of desoxyribose purines and pyrimidines may have some relevance to the problem of nucleoside phosphate origins. (H.M.G.)

33500 ISODOSE STUDIES OF RADIUM PATTERNS SUITABLE FOR TREATMENT OF CERVICAL CANCER. PART II. P. R. Blahey, R. A. Beique, and P. M. Corry (Montreal General Hospital). Obstet. Gynecol., 20: 719-25(Dec. 1962).

Optimum geometric patterns of radiation distribution were determined using an ionization chamber and 25-mg Ra units suspended in water. Isodose curves were plotted on all Ra patterns with optimum radium distribution suitable for the treatment of cervical cancer. Certain patterns were selected as preferable for adequate, uniform radiation to the uterus and the major portion or all of the vagina without excessive radiation to bowel or bladder mucosa. With controlled Ra patterns, a standard may be set for a 2-cm dose with specific reference to intensities of radiation to bowel and bladder mucosa as well as the parametrium. In each of the selected patterns the isodose lines at 2.0 cm anterior or posterior to the Ra axis remained almost a straight line along the full length of the pattern. This eliminates hot and cold spots of radiation and delivers a calculated dose of radiation to the vital structures. It is recommended that in the presence of adequate room in the vagina and in the absence of its carcinomatous involvement, additional spacers of 5.0-mm thickness may be introduced to displace bowel or bladder at a controlled distance. To determine the degree of symmetry and deviation of the Ra patterns used in the pelvis, 100 consecutive applications of Ra were reviewed. The mean deviation of the radium axis from the mid-line of the pelvis to either the right or the left side was 3.9 mm on a plane level with the upper border of the femoral heads, which is considered symmetric. It is calculated that when a 2-cm dose of 8000 r is achieved by Ra, the lateral pelvic dose may be calculated at 1760 r (or 22%). The center of this area of the lateral pelvis receives a slightly higher dose of radia-

tion; nevertheless, it is not in excess of 32% of the 2-cm dose of C, 2560 r. The remainder of the therapy to the pelvis may be integrated by the symmetric split-field technic. (H.H.D.)

33501 INTERNAL IRRADIATION OF PARENCHYMATOUS ORGANS BY INJECTION OF COLLOIDAL Au^{198} INTO THE MAIN DUCT: A NEW METHOD FOR IRRADIATING NEOPLASMS OF THE LIVER, PANCREAS, AND PAROTID. A. Ruffo and P. Rossotto (Università, Turin). Panminerva Med., 3: 559-66(Dec. 1961).

In order to obtain homogeneous irradiation of a particular organ over a long period, it is desirable for the substance injected to become evenly distributed in the organ itself and to be fixed within the cells. This can be achieved only by causing the isotope to circulate exclusively in the organ to be irradiated and not in the general circulation. It was previously noted that colloidal gold injected into the parotid duct becomes concentrated in the nucleus, mitochondria, and in the infra- and supranuclear canalicular system of the parotid cells, suggesting that it is possible to obtain an even distribution of irradiation in glandular organs by injecting colloidal radiogold into a duct. A radioautographic study of the distribution of colloidal gold injected into various organs through a duct or vein was made by injecting 200 μc colloidal Au^{198} into the hepatic artery, portal vein, and common bile duct of rabbits which were then sacrificed after 72 hr. In other rabbits, 160 μc colloidal Au^{198} was injected into the duct of the pancreas. Two μc/g were injected into the duct of the parotid and pancreas taken from the rabbit, dog, calf, and man. Injection of colloidal Au^{198} into the pancreatic duct of the rabbit, calf, and man was followed by a high and even concentration of radioactivity over the entire surface of the gland. When radiogold was injected into the pancreatic duct, radioactivity in liver, spleen, and lungs was only slightly higher than the background radioactivity; most of the radioactivity remained in the pancreas even 72 hr after injection. Confirmation by radioautography showed a total absence of radioactivity in the lungs, liver, and spleen, and 72 hr after injection the radioactivity in pancreas remained high and uniformly distributed over the entire gland. Similarly, after injecting colloidal Au^{198} into the liver, the liver contained a high concentration of radioactivity three days later in every case, whether injection had been through the hepatic artery, portal vein, or common bile duct. Whatever the route of injection, spleen always contained radioactivity, though it was very little when the Au was injected into the common duct. It is concluded that the best way of fixing colloidal radioactive substances in the liver is by injecting them into the common duct and that it is possible to achieve internal irradiation of a gland by injecting colloidal radiogold into the main duct. It should thus be possible to irradiate pancreas and salivary glands as well as the liver by introducing radioactive substances in such a way as to enter their parenchymal cells and act on the nuclei. (TCO)

33502 STUDIES IN THE INDUCTION OF MUTATIONS IN ARABIDOPSIS THALIANA (L.) HEYNH. A. D. McKelvie (North of Scotland Coll. of Agriculture, Aberdeen, Scotland). Radiation Botany, 3: 105-23(July 1963). (In English)

Arabidopsis thaliana (L.) Heynh. has proved to be a useful organism for mutation research because of its short life cycle and the ease with which morphologically distinctive mutants can be induced. Approximately 1000 such mutants were produced in an attempt to look for mutagenic agents giving high mutation rates and offering prospects of mutation specificity. The maximum mutation rate obtained was 80 per cent with ethyl methane sulfonate. The order of efficiency of the agents tested was ethyl methane sulfonate, ethyleneimine, x rays + synkavit, x rays, tritiated synkavit, nebularine, mercaptopurine, aminopterin, and nitrogen mustard. Because of the wide range of mutant types induced, there were insufficient mutants of any one type to enable definite conclusions to be made about differential response. There was good evidence, in the case of a few mutants, of slight differences in spectrum, both genetically and phenotypically, between alkylating agents and radiation. Mutants induced by alkylating agents tended to be more pleiotropic and occurred at less readily mutable loci than mutants induced by radiation. The claims of other research workers concerning differential response are discussed and it is concluded that although there are good theoretical grounds for mutation specificity, in practice it is unlikely to be of any value for mutation breeding. (auth)

33503 ACTIVATION ANALYSIS OF SODIUM AND POTASSIUM CONTENT OF SEA-URCHIN EGG AND IONIC TRANSPORT ACROSS EGG MEMBRANE. Reiji Hori. Radioisotopes (Tokyo), 12: 115-19(May 1963). (In Japanese)

33504 ON THE PROBLEM OF THE OPTIMAL DOSE IN THE RADIOTHERAPY OF NONMALIGNANT DISEASES. R. Pape (Rontgeninstitut des Wilhelminenspitals, Vienna). Radiol. Austriaca, 12: 193-202(1961).

Dosage for the treatment of benign conditions is considered from the viewpoint of 15 yr experience with 2514 patients. It was judged that doses of 1 to 20 r are optimal for treatment of inflammatory and degenerative joint diseases, although many authors call for 30- to 50-r single doses for these conditions. Equally good subjective results were obtained in arthritis and spondylitis cases with the lower doses, but suggestion plays a large role in improvement following radiotherapy. For juvenile mastitis, surface doses of 10 to 12 r, giving depth doses of ~1 r at 5 cm, are recommended. Some estimates were made of gonadal doses encountered in various types of nonabdominal radiotherapy. For example, 10-r doses of 90-kv x rays given in the axillary region result in ovarian doses of 0.2 mr. The effect of radiation on the brain and other neural structures is discussed. (H.H.D.)

33505 NEVADA TEST SITE STUDY AREAS AND SPECIMEN DEPOSITORIES. Dorald M. Allred, D. Elden Beck, and Clive D. Jorgensen. Brigham Young Univ. Sci. Bull., Biol. Ser., 2: No. 4, 1-15(May 1963).

Information on the specific location and ecological peculiarities of the animal collection stations is presented and the depositories of animal specimens on the Nevada Test Site are listed. The predominant species of plants found in greatest abundance at the study site are also listed. (C.E.S.)

33506 A TECHNIC FOR KIDNEY SCANNING. J. U. Schlegel, J. Izenstark, R. M. O'Dell, and J. Cuellar (Tulane Univ., New Orleans). Southern Med. J., 55: 471-4(May 1962).

A new radioisotopic technique was developed for accurately evaluating the secretory function of the kidney. It is based on the principle that acute obstruction of the ureters causes intrapelvic pressure to rise to a point where filtration will cease while tubular secretion continues. Thus, by temporarily depriving the kidney of its excretory function it is possible to map its secretory function. I^{131}-labeled sodium iodohippurate (Hippuran) was selected since it is secreted by the tubules and has a clearance identical with p-aminohippurate (PAH). The initial experiments were conducted on dogs, in which the kidneys were exposed through an anterior approach and

both ureters catheterized. A high urine volume was established by intravenous administration of urea, following which both ureters were blocked. In 5 to 10 min, intrapelvic pressure had risen to 90 to 100 mm Hg and filtration ceased. Then ~50 mc Radiohippuran was given intravenously. The kidneys were scanned by hand with a small surgical scintillation detector. An excellent count was thus obtained over the kidneys while the urine in the pelvis was practically free of radioactivity. Renal blood flow was determined in both kidneys prior to ureteral obstruction by PAH clearances. When the ureters were then obstructed and Radiohippuran given intravenously, a close parallelism between PAH clearances and radioactivity was found. When small branches of the main renal artery were clamped, the ischemic area could be clearly delineated, due to lowered radioactivity. With improvement in technique it should be theoretically possible to detect nonfunctioning areas down to 0.5 cm in size. Successful application of this method in several patients is also described. (H.H.D.)

33507 SOME EFFECTS OF AN UNDERGROUND NUCLEAR DETONATION ON BIOTIC COMMUNITIES AT THE NEVADA TEST SITE. Clive D. Jorgensen, Dorald M. Allred, and D. Elden Beck (Brigham Young Univ., Provo, Utah). Utah Acad. Sci., Proc., 40: Pt. I, 49-61(1963).

The pre- and post-test procedures and results of vegetation analysis, mammal trapping design, invertebrate sampling, and dosimetry to determine the effects of an underground nuclear detonation on biotic communities are presented. (C.E.S.)

33508 AUTOMATIC TRANSMISSION AND PROCESSING OF RADIOISOTOPE DATA. Bergene Kawin (Veterans Administration Hospital, Fort Howard, Md.). 7p. (CONF-164-6)

From Society of Nuclear Medicine 10th Annual Meeting, Montreal, June 1963.

A computer and X-Y plotter are used to produce contour maps for use in visual interpretation of radioisotope scan data. (T.F.H.)

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Refer also to abstract 33785.

33509 (HW-SA-2509) PROJECT CHARIOT RADIOECOLOGICAL STUDIES. J. J. Davis (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 27, 1962. Contract AT(45-1)-1350. 13p.

Data are presented from studies of radionuclides in the freshwater and terrestrial environments of the Project Chariot site on the northwest coast of Alaska. Levels of radionuclides in the environment and in plants and animals representative of different toxa and habits are presented for 1959, 1960, and 1961. (C.H.)

33510 (TID-18990) EVALUATION AND INTERPRETATION OF CALCIUM-KINETIC DATA IN MAN. Robert P. Heaney (Creighton Memorial St. Joseph's Hospital, Omaha and Creighton Univ., Omaha. School of Medicine). [1962]. Contract AT(11-1)-587. 42p.

The theoretical basis and analytical methods used in tracer studies of Ca kinetics in man are reviewed. Methods used in the measurement of bone formation and resorption, mineral exchange between body fluids and the skeleton, turnover and exchange of various non-osseous Ca compartments, and the measurement and significance of changes in these activities in health and disease are discussed. (106 references.) (C.H.)

33511 (TID-19143) PATHWAYS OF NUCLEIC ACID SYNTHESIS. Progress Report, February 1, 1962–June 30, 1963. Richard Abrams (Montefiore Hospital, New York). July 15, 1963. Contract AT(30-1)-1818. 27p.

Progress is reported in tracer studies of polynucleotide synthesis in mammalian nuclei. Data are included on the isolation and properties of polymerases and enzyme reactions in the synthesis of ribonucleic and desoxyribonucleic acids in kidney cells in tissue cultures. (C.H.)

33512 DETERMINATION OF MINUTE TRACES OF URANIUM IN BIOLOGIC MEDIA (BLOOD AND ORGANS). C. Boire, D. Bosc, G. Hugot, and R. Platzer (Centre d'Etudes Nucleaires, Saclay, France). Acta Chim. Acad. Sci. Hung., 33: 281-6(1962). (In French)

To determine the U content of biologic materials, U is first made soluble by heating the sample in a quartz or Pt vessel with concentrated HNO_3 at 300°C; after cooling, hydrogen peroxide is added, and, after further heating, 0.1N H_2SO_4. This solution is evaporated to dryness and the residue redissolved in 10 ml 0.1N H_2SO_4. One ml of a 10% solution of hydroxylamine sulfate is added to reduce Fe to the ferrous form. Uranium is then extracted, as uranyl ion, by shaking the aqueous solution with 3 ml of a 5% solution of trioctylamine in benzene. After shaking for 15 min, the organic phase is decanted and the aqueous phase extracted with an additional 1 ml of benzene. By addition of 3 ml 0.025M ammonium carbonate, the U complex is extracted from benzene. The aqueous extract is removed, evaporated to dryness at 100°, and calcined at 700°C in a Pt crucible. The residue is redissolved in 1 ml HNO_3, which is then evaporated, and fused at 900°C with sodium fluoride. Uranium in the solution of this product is estimated by fluorimetry at bands between 4700 and 6000 Å, with an exciting wavelength of 3600 Å. Recovery of U, at very low concentrations, by this method was 95 to 99% with a precision of 5 to 20%. Uranium contents of various human tissues assayed by this method were (as 10^{-3} μg U/g): intestine 8–10, pancreas 5–9, muscle 11–12, heart 3–7, liver 4–6, bone 6–12, lung 6–9, kidney 2–12, brain 3–6, and skin 25–37. (TCO)

33513 QUANTITATIVE BERYLLIUM STUDIES IN POSTMORTEM LUNGS. Jan Lieben, John A. Dattoli, and Virginia M. Vought. Arch. Environ. Health, 7: 183-7(Aug. 1963).

Analysis of lungs from residents of a neighborhood in which a beryllium factory was located, from exposed beryllium workers, and from persons who washed contaminated clothing yields the following conclusions: (1) the finding of beryllium in the lungs does not necessarily mean a person has berylliosis, (2) the amount of beryllium in the lung is not necessarily related to the severity or even presence of berylliosis, (3) amounts of beryllium in various parts of the lungs vary as much as ten times, and on occasion a single sample may be reported as negative in a person whose lungs contain substantial amounts of beryllium, and (4) a negative report of a single beryllium assay should not be used to rule out berylliosis when the rest of the findings and history are compatible with the diagnosis, and a positive or high beryllium assay be used as the sole criterion for the diagnosis of the disease. (auth)

33514 TOXICITY AND TOLERANCE STUDIES ON AET. Calvin Hanna and Norma V. Colclough (Univ. of Arkansas, Little Rock). Arch. Intern. Pharmacodyn., 142: 510-15(Apr. 1, 1963). (In English)

Attempts were made to develop administration schedules that would lower the toxicity of the radioprotective agent 2-aminoethylisothiouronium bromide hydrobromide (AET) by studies in rats, rabbits, and dogs. The acute intraperitoneal LD_{50} for this agent in these species was 288, 236 and ~113 mg/kg, respectively. Repeated and increasing intraperitoneal doses of AET in rats over 14 days allowed the animals to tolerate a 25% larger dose. A similar tolerance was obtained with the dog over 12 to 20 days but not with the rabbit over 7 days. A radioprotective dose of AET in the rat to double the tolerated x-ray or γ-ray dose is ~300 mg/kg. The tolerance developed to AET in the dog or rabbit was not great enough to reach such a dose of AET. Symptoms of AET toxicity are described for rats, dogs, and rabbits. Dogs receiving AET intraperitoneally suffered from lesions at the site of injection and showed marked wt loss while dogs receiving repeated oral doses of AET were healthier and better tolerated the intraperitoneal challenging dose of 200 mg/kg. Development of tolerance to intraperitoneal doses was 25%, and similar results were obtained when 0.25 mg/kg of atropine sulfate was given concomitantly with the AET. At autopsy, gross examination of the dogs revealed only drug-induced changes at the site of injection, such as ulcerations in the peritoneum and surrounding abdominal muscles. (TCO)

33515 INHIBITION, BY CERTAIN RADIOPROTECTANTS, OF THE METABOLISM OF HEXOBARBITAL IN THE PRESENCE OF THE ENZYME SYSTEM IN LIVER MICROSOMES. C. Liebecq, Alexandra Thomou, and Z. M. Bacq (Université, Liège). Arch. Intern. Physiol. Biochim., 71: 313(Mar. 1963). (In French)

The effect of radioprotective agents, added in vitro, on the ability of rat liver microsomes to metabolize hexobarbital was investigated. Cysteamine and 5-hydroxytryptamine (serotonin), at concentrations corresponding to those used in radioprotection experiments, inhibited the enzyme system. This inhibition did not involve the reduction of nicotinamide adenine dinucleotide by enzymes of the soluble fraction of liver homogenate, but rather the re-oxidation of this coenzyme in the reduced form. Cysteamine was not inhibitory as long as it was not reduced. Histamine showed an initial stimulating effect on hexobarbital metabolism, which was later changed to an inhibitory action. (H.H.D.)

33516 TOTAL DIET STUDY: A. STRONTIUM-90 AND CESIUM-137 CONTENT. Edwin P. Laug, Anthony Mikalis, Howard M. Bollinger, and James M. Dimitroff. B. NUTRIENT CONTENT. M. J. Deutsch, D. Duffy, H. C. Pillsbury, and H. W. Loy. C. PESTICIDE CONTENT. Paul A. Mills (Food and Drug Administration, Washington, D. C.). J. Assoc. Offic. Agr. Chemists, 46: 749-67(Aug. 1963).

A total diet, representing the normal 14-day intake of males 16 to 19 yr old was composited, and portions of the composite were analyzed for contents of Sr^{90}, Cs^{137}, nutrients, and pesticide residues. Results showed that waste segments and dairy products contain extremely large proportions of the Sr^{90} in relation to the percentage by weight of the total diet that they represent. Sr^{90} in the total diet has increased steadily since May 1961. Cs^{137} is about 2 to 3 times the Sr^{90} in the total diet. The nutrient content of the diet meets recommended dietary allowances, even after processing and preparation. Residues of nine chlorinated pesticides and eight organo-phosphates were detected, all at extremely low levels. (auth)

33517 CHANGES IN THYROIDAL FUNCTION DURING ADAPTATION TO LARGE DOSES OF IODIDE. Lewis E. Braverman and Sidney H. Ingbar (Boston City Hospital and Harvard Medical School, Boston). J. Clin. Invest., 42: 1216-31(Aug. 1963).

Studies were conducted to determine the mechanism whereby the acute inhibitory effect of large doses of iodide on the organic binding of thyroidal iodide (Wolff-Chaikoff effect) is overcome during prolonged iodide administration (adaptation or escape phenomenon). Thyroids of control rats and of rats adapted to iodide in vivo were freed of inorganic iodide by in vivo administration of thiocyanate and in vitro leaching, and were then incubated in media containing inorganic I^{131} of widely varying specific activity. In vitro, when exposed to low concentrations of extracellular iodide, thyroids of control animals accumulated and organically bound more iodine than did adapted glands. As the extracellular iodide concentration was increased, the total iodine accumulation in control thyroids increased; however, the quantity of iodine bound organically ultimately declined. At this point, ratios of labeled mono- to diiodotyrosine rose. Thus, a Wolff-Chaikoff effect was induced in vitro in control glands. In adapted thyroids, far less iodine entered the thyroid, but especially at higher concentrations of extracellular iodide, the percentage of accumulated iodide bound organically did not decline so rapidly as in controls. As a result, total organic binding rose progressively and, at high iodide concentrations in the medium, exceeded that in control glands. Mono- to diiodotyrosine ratios did not increase. Thus, escape from the inhibitory effects of iodide was evident in vitro in adapted thyroids. At each concentration of extracellular iodide, far less inorganic iodide was found in adapted than in control glands, and the concentration of thyroidal iodide achieved by adapted thyroids at the highest medium iodide concentrations used was far less than that sufficient to induce the Wolff-Chaikoff effect in control glands. In the presence of blocking concentrations of methimazole, the iodide-transport capacity of adapted thyroids was far lower than that of control glands. Qualitatively similar data were obtained in studies of the thyroids of control and adapted hypophysectomized rats. Administration of thyroid-stimulating hormone to adapted rats did not alter their in vitro iodine metabolism, or their ability to resist the inhibitory effects of high concentrations of extracellular iodide. These data suggest that adaptation to the inhibitory effects of large doses of iodide occurs through an intrinsic thyroidal mechanism that reduces the thyroidal iodide-transport capacity and thereby allows intrathyroidal iodide to decline to concentrations insufficient to sustain the Wolff-Chaikoff effect. (auth)

33518 SOME DIFFERENCES IN ERYTHROCYTE COMPOSITION AND UPTAKE OF RADIOACTIVE POTASSIUM, SODIUM, CHROMATE, AND TRIIODOTHYRONINE ASSOCIATED WITH IN VIVO AGING. E. Raymond Borun (Univ. of California Medical Center, Los Angeles). J. Lab. Clin. Med., 62: 263-78(Aug. 1963).

Differences in chemical composition and uptake of tracer amounts of several radioactive substances were determined in populations of young and old human and rabbit erythrocytes which were separated on the basis of their density gradient. The old erythrocytes contained less water, potassium, chloride, bicarbonate, and organic phosphate than the young cells, but contained similar amounts of sodium and magnesium. It is suggested that a decrease in the transmembrane concentration gradients of potassium and sodium may be characteristic of senescence. Reticulocyte-rich populations of rabbit cells exhibited more uptake of K^{42}, Cr^{51}, and I^{131}-triiodothyronine, and less uptake of Na^{22}, than did the mature erythrocytes. These differences in uptake

may be related to an alteration of the cell membrane during maturation. (auth)

33519 EFFECT OF DEUTERIUM OXIDE ON LOCAL ANESTHETIC ACTIVITY OF PROCAINE. S. V. Susina, F. D. Hiter, F. P. Siegel, and M. I. Blake (Univ. of Illinois, Chicago). J. Pharm. Sci., 51: 1166-9(Dec. 1962).

Since it appears that D_2O is toxic in animals only when the concentration in the body fluids reaches high levels (>20%), and since D_2O resembles the common solvent protium oxide more closely than any other, possible pharmaceutical applications of this solvent were explored. In studies in mice, D_2O was used as a solvent for procaine and the effect on the stability and local anesthetic activity was noted. The ED_{50} was determined by the method using corneal sensitivity, and comparison was made with procaine solutions in H_2O. In H_2O the ED_{50} was 1.8% while in D_2O it was 1.0%. The LD_{50} was determined by intraperitoneal injection in mice. There appeared to be no significant difference in the toxicity of procaine in either solvent. Stability studies indicate that procaine is more stable in D_2O than H_2O at apparent pH values of 8.0, 8.5, and 9.0. Hence, the increased local anesthetic activity of procaine in D_2O may be accounted for by the fact that procaine free base is more stable in D_2O solutions, or that at the same apparent pH a D_2O solution of procaine will contain more free base than in the corresponding aqueous solution. (H.H.D.)

33520 EVALUATION OF THYROID FUNCTION BY THE TWO-PHASE RADIOIODINE METABOLISM TEST. Boris Kastelic and Bojan Varl (Internal Medicine Clinic of Medical Faculty, Radioisotope Lab., Ljubljana, Yugoslavia). Med. Glasnik, 17: 109-11(Mar.-Apr. 1963).

Data from 832 patients in whom various radioiodine tests were made during the course of the past year are reported. A graph is given showing percentage of eu- and hyperthyroid patients plotted against percentage of fixation and time. Various other indices are also included. The test is highly praised as a diagnostic aid in thyroid conditions. (TCO)

33521 DATA RELATIVE TO THE TOXICOLOGY OF RADIOIODINE. P. P. Saksonov and G. F. Fakhrutdinov. Med. Radiol., 8: No. 5, 29-32(May 1963). (In Russian)

Experimental data relative to the development of radiation affections consequent upon the introduction of massive radioiodine doses into the organism are presented. As the result of investigations it was disclosed that radioiodine in doses of 24 to 40 mC/kg provokes a severe affection in rats with death occurring in most cases. In doses of 4 and 8 mC/kg complete destruction of the thyroid gland takes place and the animals do not perish for one year. In dogs receiving 5 mC/kg of radioiodine, radiation sickness supervenes with a lethal issue in individual cases, whereby a dose of 1.7 mC/kg causes only a weak leukopenic reaction. The features peculiar to radiation affection consequent upon the administration of large radioiodine doses, apart from complete destruction of the thyroid gland, consist of the prevalent involvement of respiratory organs and the urinary system. (auth)

33522 THE INCLUSION OF 4-C^{14}-LABELED CHOLESTEROL INTO BLOOD SERUM LIPOPROTEIN FRACTIONS IN ATHEROSCLEROSIS. A. P. Golikov. Med. Radiol., 8: No. 5, 44-7(May 1963). (In Russian)

4-C^{14}-labeled cholesterol was utilized for studying its distribution in blood serum lipoprotein fractions of healthy rabbits and animals with experimental atherosclerosis. The fact of inclusion of exogenous, 4-C^{14}-labeled cholesterol in particular, into the lipoprotein fractions was established. Inclusion in beta-lipoprotein fraction was more intensive in animals with experimental atherosclerosis. (auth)

33523 DEPOSITION AND DISTRIBUTION OF Sr^{90} IN THE TEETH OF DOGS. E. I. Yartsev. Med. Radiol., 8: No. 5, 47-50(May 1963). (In Russian)

In experiments staged on 26 dogs receiving low quantities of Sr^{90} throughout their life, it was established that the level of isotope accumulation in the teeth is higher than in the tubular bones. Using autoradiography it was found that Sr^{90} is distributed unevenly in the dental tissues; the content of the radioactive substance is higher in the pulpal dentin and cementum. (auth)

33524 LEAD-210 AND POLONIUM-210 IN HUMAN TISSUES. R. V. Osborne (Royal Cancer Hospital, London). Nature, 199: 295(July 20, 1963).

It has recently been shown that appreciable amounts of Pb^{210} and Po^{210} may occur in certain human foodstuffs as a result of deposition from the atmosphere of long-lived radon decay-products. The ratio of Po^{210} to Pb^{210} in bone and activities of these nuclides in human soft tissue have been reported for only a few samples. Results of preliminary radiochemical estimations of Po^{210} and Pb^{210} in human bone and soft tissue are described. (H.M.G.)

33525 THE ENTRY OF STRONTIUM INTO POTATO TUBERS AFTER FOLIAR CONTAMINATION. J. Moorby and H. M. Squire (A.R.C. Radiobiological Lab., Wantage, Berks, Eng.). Radiation Botany, 3: 95-8(July 1963). (In English)

When the foliage of potato plants was sprayed with radioactive Sr and the plants grown in the open, a small quantity of the Sr passed into the tubers. This could be prevented by protecting the plants from rain and covering the soil. The contamination of tubers from plants exposed to rain was not due to the translocation of Sr within the plant, but was caused by Sr washed from the leaves by rain. Strontium that entered the tubers in this way appeared to do so three times as readily as Sr applied to the soil at the time the potatoes were planted. (auth)

33526 THE EFFECT OF AET (β-AMINOETHYLISOTHIURONIUM) ON THYROID FUNCTION IN THE RAT. Yosh Maruyama (Stanford Univ., Calif.). Radiation Res., 19: 538-50(July 1963).

AET and MEG depress the uptake of I^{131} by the thyroid gland in the rat. It is, however, unassociated with any increase in thyroidal mass in a chronic administration study, shows no evidence of hyperplasia on histological section, and does not affect the release of I^{131} from the thyroid gland. It is concluded that there is no direct antithyroidal activity but a depression of uptake by extrathyroidal mechanisms which have been discussed. (auth)

33527 LONG-TERM Cs^{137} TURNOVER IN MAN AS MEASURED BY A WHOLE-BODY COUNTER. Stanton H. Cohn, Betty Rosoff, Ernest A. Gusmano, and Herta Spencer (Brookhaven National Lab., Upton, N. Y.). Radiation Res., 19: 655-8(Aug. 1963). (BNL-6494)

In order to assess the radiation hazard of the fission product Cs^{137}, it is necessary to determine its long-term turnover rate in man. Results are reported from a long-term study of Cs^{137} made on five patients. Measurements of whole-body retention were made with the Brookhaven whole-body counter. It has been found that the technique of radiochemical analysis of excreta is of limited sensitivity for determining whole-body retention at very long periods

of time after isotope administration. In order to assay the radiation hazard, it is further necessary to estimate the retention over the normal life span of man on the basis of the data obtained. Thus a mathematical model must be developed from which long-term extrapolations can be made. Data analysis was carried out with the use of a computer in order to determine the parameters of the mathematical functions that best describe these data. (auth)

33528 THE TRANSFER OF Na^{24} AND K^{42} FROM BLOOD TO BILE IN THE GUINEA PIG IN THE COURSE OF CHOLERESIS BY STOP-FLOW ANALYSIS. J. Chenderovitch, S. Troupel, H. Renault, and J. Caroli (Institut National d'Hygiene and Hopital Saint Antoine, Paris). Rev. Franc. Etudes Clin. Biol., 6: 584-9(June 1961). (In French)

Na^{24} and K^{42} were injected intravenously in guinea pigs while the bile duct was clamped, and their concentrations in successive drops of bile were measured. Both ions behaved similarly. Concentrations in the drops rose sharply, reaching a max by the 3rd to 4th drop, then falling to level off after ~15 drops. The blood concentration remained level over this period. The results indicate that all segments of the biliary tree are completely permeable to these cations. No evidence for their active secretion by bile epithelium or selective reabsorption was found. Concentrations of Na^{24} and K^{42} were consistently higher in bile than in blood. (H.H.D.)

33529 THE TRANSFER OF I^{131} AND Br^{82} FROM BLOOD TO BILE IN THE GUINEA PIG DURING THE COURSE OF CHOLERESIS BY STOP-FLOW ANALYSIS. J. Chenderovitch, E. Phocas, S. Troupel, H. Renault, and J. Caroli (Institut National d'Hygiene and Hôpital Saint Antoine, Paris). Rev. Franc. Etudes Clin. Biol., 7: 535-8 (May 1962). (In French)

Although passage of electrolytes into the bile from blood has heretofore been considered to be a passive process of diffusion, present experiments indicate a selective transfer of anions and cations to bile. I^{131} and Br^{82} in doses of 70 to 100 μc were injected intravenously into guinea pigs, and the catheterized bile duct was clamped at 10-min intervals. Results with the two isotopes were identical. The concentrations of I^{131} and Br^{82} in successive drops of bile increased rapidly, then more slowly, reaching a max after passage of 10 to 15 drops. This was followed by a gradual decline of isotope content of the bile. The isotope content of blood fell steadily over this period. In other experiments in which the blood concentrations of I^{131} and Br^{82} were maintained constant, no segmental variations in their bile levels were observed. The results indicate that these anions are not transferred across the terminal portion of the biliary tract (distal to the lobules), although the entire tract is permeable to anions. No secretion or reabsorption of the anions could be demonstrated. Contrary to what was previously found with Na^{24} and K^{42}, the concentrations of I^{131} and Br^{82} are always lower in bile than blood, indicating a selective transfer of electrolytes into bile. (H.H.D.)

Fallout and Ecology

Refer also to abstracts 34152, 34182, and 34184.

33530 (EUR-294.i) SORVEGLIANZA DELLA RADIOATTIVITA' DEL LATTE A ISPRA RISULTATI DEL PERIODO, 1960-1962. (Monitoring of Radioactivity in Milk at Ispra-Results Obtained in the Period, 1960-1962). M. de Bortoli, P. Gaglione, A. Malvicini, and E. van der Stricht (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 41p.

Data on milk radioactivity obtained at Ispra in the period 1960 to 1962 are presented. Particular concern was given to the observed ratio [U. S. (milk)/U. S. (diet)], the ratio U. S./U.K., and the relative contribution of direct and indirect contamination evaluated by the Sr^{89}/Sr^{90} ratio. The methods of analysis and measurements are described. (auth)

33531 OBSERVATION OF FALL-OUT AROUND OUR LABORATORY IN 1962. Tetsuo Mamuro, Akira Fujita, Tadao Matsunami, Kazuko Yoshikawa, and Toshio Azuma. Ann. Rept. Radiation Center Osaka Prefect., 3: 1-5(1962). (In English)

Measurements were made on the concentration of fallout in the atmosphere, in a water basin, and in rain water at the Radiation Center of Osaka Prefecture during 1962. Only weakly radioactive fallout particles were found in spring rain water, but highly radioactive fallout particles began to appear in rain water in July and Nov. Concentrations in the atmosphere were similar to those found in rain water. The activities measured in the basin showed high values in the period of spring maximum. In July and August, the amount of fallout decreased considerably; however, it increased again under the influence of new test series in 1962. The detection of highly radioactive fallout particles in Nov. is discussed. (P.C.H.)

33532 SOLUBILITY OF FALL-OUT PARTICLES. Tetsuo Mamuro, Nobufumi Maki, and Tadao Matsunami. Ann. Rept. Radiation Center Osaka Prefect., 3: 19-21 (1962). (In English)

Solubility tests were made on fallout particles in airborne dusts, rain water, and highly radioactive particles. It was found that particles in airborne dusts could not be dissolved completely in 6N HCl, and particles in rain water could not be dissolved completely in either 6N HCl or hot aqua regia. Fusion by alkali bisulfate was found to be the most effective method for dissolving fallout particles. (P.C.H.)

33533 RELIABILITY OF A MEASURED VALUE OF THE ACTIVITY CONCENTRATION IN THE ATMOSPHERE. Akira Fujita and Tetsuo Mamuro. Ann. Rept. Radiation Center Osaka Prefect., 3: 22-5(1962). (In English)

Experiments were carried out in order to examine the relation between the volume of sampled air and the reliability of a measured value of the activity concentration. It was concluded that if the volume of air sample is small, the reliability of the measured value of activity concentration will be less. The reliability would be least in the early state of the period when the activity concentration is increasing rapidly, because the atmosphere contains highly radioactive particles in this state, while the activity concentration has not reached its maximum. In this case, a large volume air sample should be used. (P.C.H.)

33534 THE RADIOACTIVE CONTAMINATION OF RABBITS FED WITH CLOVER CONTAMINATED BY FALLOUT. [PART] II. Kazuo Nishio, Sakiko Sugiura, Yasuharu Hori, Atsuhiko Takeda, and Yasuhiko Takamori. Ann. Rept. Radiation Center Osaka Prefect., 3: 137-40 (1962). (In English)

The effects of clover contaminated with fallout on rabbits (some born as early as 1957) were studied. The highest dose of radioisotopes administered seemed to be about 10.9 μC by September 1962. No visible change or radiation injury, distinctly due to fallout, was observed by September 1962. Late effects were not studied. (P.C.H.)

33535 STUDIES OF RADIOACTIVE FALL-OUT FOLLOWING 1961 U.S.S.R. TESTS. Alan Walton, Micah W. M.

Leo, and Philip W. Krey (Isotopes, Inc., Westwood, N. J.). Nature, 199: 526-31(Aug. 10, 1963).

An investigation was made of the deposition of fallout at Westwood, N. J., immediately prior to and immediately following the Soviet atmospheric tests of 1961. Data are presented on total deposition, rate of deposition, and composition of fallout in atmospheric and rain water samples. (C.H.)

33536 RADIOACTIVITY OF AIR DUST, RAIN WATER AND TURF GRASS IN BANDUNG, JAVA. A. Suszkin (Padjadjaran State Univ., Bandung, Indonesia). Nature, 199: 584(Aug. 10, 1963).

Data are presented on the radioactivity in samples of air dust, rain water, and turf grass collected at Bandung, Indonesia, between Nov. 1961 and Dec. 1962. (C.H.)

33537 DESIGN OF THE BROOKHAVEN EXPERIMENT ON THE EFFECTS OF IONIZING RADIATION ON A TERRESTRIAL ECOSYSTEM. George M. Woodwell (Brookhaven National Lab., Upton, N. Y.). Radiation Botany, 3: 125-33(July 1963). (BNL-6772) (In English)

A forest ecosystem on Long Island is being irradiated experimentally with chronic γ radiation and will be studied over a period of years to appraise the potential effects of ionizing radiation at ecological levels of organization. The source of radiation is Cs^{137}, arranged for safety and simplicity of dosimetry in a centrally located tower and capable of being shielded by operation of a winch in a remote building. Exposure rate decreases around this tower approximately with the square of the distance from the source and may vary by a factor of 2 along any arc around it owing to shielding by the vegetation. The steep decline in exposure rate with increasing distance from the source produces steep gradients of effects and the amount of replication, especially at the species level and during the first year of the study when principal effects are close to the source, may be small. Two types of control data are available from measurements of plant and animal populations in the experimental area prior to irradiation and other measurements from nonirradiated stands nearby. Within the experiment, data can be referred to a radial survey which defines location with reference to the source and hence exposure rate. Results of the first year's exposure of a stand of the Long Island oak–pine forest show that although plant populations were generally more sensitive to damage than had been anticipated, the first year's effects on plants can be predicted within broad limits from characteristics of the cell nucleus. The ability to make such predictions is of great value in planning this type of experiment. (auth)

33538 THE LOSS OF RADIOACTIVE ISOTOPES FROM THE LEAVES OF PLANTS IN DRY CONDITIONS. J. Moorby and H. M. Squire (A.R.C. Radiobiological Lab., Wantage, Berks, Eng.). Radiation Botany, 3: 163-7(July 1963). (In English)

When radioactive isotopes are applied to the foliage of plants varying amounts of the isotopes may be subsequently lost from the plants when they are kept in dry conditions. Losses appear to be greatest in good growing conditions in the summer. It has been possible to demonstrate the transfer of Sr^{89} to uncontaminated plants and to trap it in air filters. It is suggested that materials might be lost from leaf surface in association with small wax particles, but no conclusive evidence is available. (auth)

33539 RADIOECOLOGY. Proceedings of the First National Symposium on Radioecology Held at Colorado State University, Fort Collins, Colorado, September 10-15, 1961. Vincent Schultz and Alfred W. Klement, Jr., eds. New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963. 759p. $16.50.

Separate abstracts were prepared for 76 papers in this conference. Eleven papers were previously abstracted for NSA. (2452 references.) (C.H.)

33540 IMPACT OF ATOMIC ENERGY ON THE ENVIRONMENT AND ENVIRONMENTAL SCIENCE. John N. Wolfe (U. S. Atomic Energy Commission, Washington, D. C.). p.1-2 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The impact of atomic energy on the environment and on environmental science is reviewed briefly. It is pointed out that no era has ever had a genesis so suddenly emergent as has the era of atomic energy and that the atom will have notable ecological implications in the decades ahead. The hazards of reckless and inconsiderate utilization of atomic energy are stressed. (C.H.)

33541 RADIATION EFFECTS AND PEACEFUL USES OF ATOMIC ENERGY IN THE PLANT AND SOIL SCIENCES. John D. Spikes (Univ. of Utah, Salt Lake City). p.5-11 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Applications of atomic energy in soil sciences and studies on higher plants are reviewed. Topics discussed include: radiation effects on plant growth and metabolism; the ecological effects of radiation in plants; applications of radiation in plant breeding programs; applications of radiation in processing of foods to prevent spoilage and increase storage life; the use of induced radioactivity in the analysis of plants; and the application of tracer techniques in soil studies. It is concluded that nuclear science offers a powerful array of tools to ecological science and that the future will produce many new developments in techniques. (C.H.)

33542 RADIATION EFFECTS AND PEACEFUL USES OF ATOMIC ENERGY IN THE ANIMAL SCIENCES: RADIATION AND BIOLOGIC CAPABILITY. Paul S. Henshaw (U. S. Atomic Energy Commission, Washington, D. C.). p.13-17 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The analysis of ecosystem capability at various levels of biologic specialization in terms of the ratio of maximum performance capability to deterent counterforce is discussed from the point of view of radiation effects on the biologic capability of animals. Points of vulnerability are classified as those tissues involved in maintenance of the organism as a functioning mechanism, those involved in defense of the organism against infection, those involved in reproduction, and those involved in the acquisition and utilization of acquired information. It is pointed out that radiation may cause death of some cells, or may cause temporary or permanent changes in performance capability of the cells. The radiosensitivity of various tissues and organs is compared. The relationship of biological capability and aging is discussed and similarities in aging and radioinduced reduction in capabilities are discussed. Methods of measuring survival and performance capability in animals are reviewed. (C.H.)

33543 CONTINENTAL CLOSE-IN FALLOUT: ITS HISTORY, MEASUREMENT AND CHARACTERISTICS. Kermit H. Larson (Univ. of California, Los Angeles).

p.19-25 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The history of fallout studies is reviewed. The characteristics of fallout, methods used for the measurement of fallout, and biological effects of fallout are discussed. Results are included from radiological and biological surveys of the Trinity Test Site, New Mexico, and the Nevada Proving Grounds area. (C.H.)

33544 DISPOSAL OF RADIOACTIVE WASTES: ITS HISTORY, STATUS, AND POSSIBLE IMPACT ON THE ENVIRONMENT. Donald W. Pritchard (Johns Hopkins Univ., Baltimore) and Arnold B. Joseph. p.27-31 of "Radioecology." New York, Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Various methods for the disposal of radioactive wastes are reviewed. It is pointed out that a very large part of the high-activity wastes are stored in tanks, or in solid or packaged form in the ground away from man's environment. Disposal of low to intermediate level liquid wastes to the ground at properly selected sites can be made without measurable impact on the environment outside the controlled disposal area. Except in the event of an earthquake or explosion, radioactive wastes stored underground have essentially no impact on the environment and there is very little impact on the environment from ground disposal of liquid wastes. (C.H.)

33545 SOME EFFECTS OF ENVIRONMENTAL FACTORS UPON ACCUMULATION OF WORLDWIDE FALLOUT IN NATURAL POPULATIONS. J. J. Davis, W. C. Hanson, and D. G. Watson (General Electric Co., Richland, Wash.). p.35-8 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963. (HW-SA-2316)

Ecological factors affecting the initial distribution of radionuclides from fallout and their subsequent cycling and accumulation within the biosphere are discussed. Results are reported from studies on the effects of some environmental factors on the distribution and translocation of radionuclides from fallout in natural populations of plants and animals in Washington and Alaska. (C.H.)

33546 VEGETATIONAL ANALYSES IN A CREOSOTE BUSH COMMUNITY AND THEIR RADIOECOLOGIC IMPLICATIONS. William H. Richard (General Electric Co., Richland, Wash.). p.39-44 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Detailed vegetational analyses were conducted on fifteen 50 × 100 feet permanent plots in a creosote bush (Larrea divaricata) community in Jackass Flats, Nye County, Nevada, in 1959 and 1960. Creosote bush dominated the canopy-coverage provided by 11 shrub species and two species of bunch grasses by contributing 6.1 per cent of the total 13.7 per cent ground cover. As creosote bush dominated the ground cover provided by shrubs, Chaenactis stevioides dominated the herbaceous understory vegetation. The amount of ground cover provided by annual species varied from year to year. Twice as much coverage was provided by understory plants in 1960 as in 1959, and the increase related to the more abundant and prolonged precipitation of the winter-spring growing season of 1960. In April 1960, the total ground cover of combined overstory and understory plants amounted to 26.7 per cent, about equally divided between the two groups. Forty herbaceous species were recorded on the study plots in 1960. The amount of ground covered by vegetative canopies, the contributions of each species to ground cover, the development and seasonal persistence of understory layers and the phenological sequence of leaf development and abscission are believed directly related to the vegetative retention of radioactive fallout by desert shrub communities. These synecological features as well as the kinds and abundance of livestock forage plants are of concern in radioecologic investigations because contaminated vegetative surfaces are recognized as the primary source of readily available radioactive fallout to all kinds of herbivorous animals. (auth)

33547 THE DYNAMICS OF FALLOUT DISTRIBUTION IN A COLORADO ALPINE TUNDRA SNOW ACCUMULATION ECOSYSTEM. William S. Osburn, Jr. (Univ. of Colorado, Boulder). p.51-71 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The ecological dynamics of the concentration of fallout radionuclides in snow bank accumulations in high mountain areas was investigated. Results are reported from studies on the ecology and distribution of radioactivity of a site located in the alpine tundra of Niwot Ridge, Boulder County, Colorado, at an altitude of approximately 11,400 ft. (C.H.)

33548 ACCUMULATION OF STRONTIUM-90 IN YEARLING COLUMBIAN BLACK-TAILED DEER, 1950-1960. Vincent Schultz (U. S. Atomic Energy Commission, Washington, D. C.) and William M. Longhurst. p.73-6 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The Sr^{90} content of jawbones of yearling Columbia black-tailed deer, Odocoileus hemionus columbianus, collected in Mendocino County, Calif., during the period 1952 through 1960 was measured. The Sr^{90} content was related to seasonal food habits, age, and home range. Results of Ca and Sr^{90} analysis show a decided increase in Sr^{90} content of the bones during the period, with maximum activity in specimens collected in 1959. (C.H.)

33549 FACTORS RELATED TO CONCENTRATION OF RADIOCESIUM IN PLANTS GROWING ON A RADIOACTIVE WASTE DISPOSAL AREA. R. E. Shanks and H. R. DeSelm (Univ. of Tennessee, Knoxville). p.97-101 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Levels of cesium-137 in 75 samples of the sedge plant, Carex Frankii, from the drained bed of White Oak Lake, on the Oak Ridge Reservation, Tennessee, were most closely related to total cesium-137 in the surface two inches of the soil, exchangeable cesium-137, calcium, and magnesium in the surface six inches, and pH, among a series of properties of corresponding soil samples. These five factors accounted for approximately half of the variation in plant radiocesium content, which equaled or exceeded the variation accounted for in parallel regressions of plant calcium, magnesium, and potassium on measured soil variables. Substitution of physical variables for the least useful chemical variables did not add much predictive value. (auth)

33550 MOVEMENT AND ACCUMULATION OF RADIOSTRONTIUM AND RADIOCESIUM IN INSECTS. D. A. Crossley, Jr. (Oak Ridge National Lab., Tenn.). p.103-5 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Studies of the insect inhabitants of vegetation on the contaminated White Oak Lake bed measured the transfer of

strontium-90 and cesium-137 from plants to insects, and evaluated the accumulation of the radionuclides by the trophic levels involved. Data on accumulation of these radionuclides by individual insect species showed that transfer of cesium-137 from plant to insect tissue was more efficient than transfer of strontium-90 (80 per cent versus 10 per cent). Differences seem due to the more rapid elimination of strontium by insects, with resulting lower equilibrium values. Per gram concentrations showed reductions in movement from soil to insects, with the major reduction occurring in the soil-to-plant step for cesium-137 and in the plant-to-insect step for strontium-90. The magnitude of such reductions is dependent upon the nature of the organisms involved. Transfer through trophic levels in this food chain (concentration per unit area) showed vast reductions at each step, due to the increasingly smaller masses of organisms involved in higher trophic levels. (auth)

33551 ESTIMATION OF DOSE RATE AND EQUILIBRIUM STATE FROM BIOACCUMULATION OF RADIONUCLIDES BY MAMMALS. Stephen V. Kaye and Paul B. Dunaway (Oak Ridge National Lab., Tenn.). p.107-11 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Dynamics of elemental cycling and equilibrium may be understood when concentrations of radioelements are measured in components of the ecosystem. Concentrations of radioactivity in mammals can be used also to estimate the dose received by individual organs or the whole body for correlation of somatic or ecological effects of radiation. Body burdens of cotton rats from the radioactively contaminated White Oak Lake bed are used as examples for calculating whole-body dose rates from radionuclides in tissues and radionuclides in the gastrointestinal tract. The dose rates estimated from the body burdens of radionuclides in muskrats from a settling basin for radioactive liquid wastes are much higher than for the cotton rats. A hypothetical situation is proposed whereby a man eats one pound of muskrat muscle and the liver of the muskrat. After two such meals separated by one week, the man's whole-body dose rate reaches the maximum permissible rate of 0.03 rems per week for the vicinity of an atomic energy installation, but decreases exponentially because of elimination if there are no subsequent ingestions. Equations are presented which give estimates of dose and dose rate for several different situations. Estimates of biological data for wild mammals are needed for dosimetry and equilibrium calculations, and to determine the applicability of laboratory animal data to wild mammals. (auth)

33552 EXPERIMENTAL ISOLATION OF FOOD CHAINS IN AN OLD-FIELD ECOSYSTEM WITH THE USE OF PHOSPHORUS-32. Eugene P. Odum and Edward J. Kuenzler (Univ. of Georgia, Athens). p.113-20 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Three dominant species of plants, Heterotheca subaxillaris, Rumex acetocella, and Sorghum halepense in an old-field ecosystem at the U. S. Atomic Energy Commission's Savannah River Plant were labeled by foliar application of phosphorus-32 in separate 100-meter quadrats in May 1957, and the subsequent amounts and distribution of tracer in animal populations were determined. When the concentration of the tracer per unit of biomass (milligrams of wet weight) was plotted against time, a clear graphic separation of certain trophic and habitat groups was evident in all three quadrats. The maximum concentration of phosphorus-32 in major populations occurred as follows: Dorymyrmex, most common ant, and Oecanthus, most common known herbivore, one to two weeks; grazing herbivores in general, two to three weeks; sedentary spiders, three to four weeks; Cryptozoa (ground beetles, crickets, etc.), four to five weeks. The trophic position of two of the most common species, whose exact food source in nature was previously unknown, was rather clearly established by comparison of their uptake curves with those of species whose food was known. In general, the most common grazing herbivores such as the several orthopteran species fed freely on all three species of dominant plants, without marked preference, while some less common species were more selective. The experiments demonstrated that labeling with radioactive tracer of single species of producers can aid in the isolation or untangling of food chains, as well as aid in determination of the energy source being utilized by specific heterotrophic populations in nature. (auth)

33553 ANALOG COMPUTER MODELS FOR MOVEMENT OF NUCLIDES THROUGH ECOSYSTEMS. Jerry S. Olson (Oak Ridge National Lab., Tenn.). p.121-5 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The interpretation of information on the rates of income and loss of radionuclides (or of nutrients, carbon, biomass, or free energy) between compartments of an ecosystem involves assumptions about the system which can be formalized in mathematical models. Electronic analog computer techniques can be viewed either as a means of solving the differential equations describing the income and losses for each compartment of the system, or as a device for stimulating the natural processes operating in the system. An example of a small analog computer model for the transfer of organic carbon or carbon-14 from photosynthetic vegetation, to roots or organic litter, to humus in mineral soil was discussed and further details are given in an Oak Ridge National Laboratory Report (Neel and Olson, 1962). Newer work in 1961 involved the use of two consoles, one to simulate the transfer of energy, of carbon, or of biomass, and a second one to simulate the cycling movement of inorganic nutrient elements or of radioactive nuclides. (auth)

33554 CYCLING AND LEVELS OF STRONTIUM-90, CERIUM-144, AND PROMETHIUM-147 IN THE ATLANTIC OCEAN. Vaughan T. Bowen (Woods Hole Oceanographic Institution, Mass.) and Thomas T. Sugihara. p.135-9 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Surface water strontium-90 concentrations are presented for 60 stations in the Atlantic and Caribbean, from 1956 to 1960. The details of one deep station are presented, together with integrated strontium-90 curves from this and six other stations. From these is developed a picture of the changing patterns of surface homogeneity of strontium-90 content, as well as of the high accumulation per unit area of this fallout product in the oceans. The differences in distribution of lanthanide radioactivities are discussed, both horizontally and vertically. Arguments are developed indicating that strontium-90 moves significantly in sea water only as a solute, and therefore traces water movement; that cerium-144 and promethium-147, though discriminated between, move significantly by association with particles, though not in the Atlantic with organisms. (auth)

33555 GROSS BETA RADIOACTIVITY IN MARINE ORGANISMS. Thomas W. Hatfield, Donald M. Skauen, and

John S. Rankin, Jr. (Univ. of Connecticut, Noank). p.141-3 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

A survey of gross beta radioactivity in organisms in the Thames River (Connecticut) and environs was carried out from April 1960, to August 1961. Analyses were made on oysters, quahogs, mussels (two species), and algae (two species). Seasonal variations in beta radioactivity were noted, suggesting correspondence with periods of dormancy and activity in these organisms, with the highest concentrations in Laminaria (kelp). Unexpected winter highs might be attributed to earlier French nuclear tests. Natural potassium-40 probably accounts for most of the beta radioactivity noted. (auth)

33556 RADIONUCLIDES IN PLANKTON AND TUNA FROM THE CENTRAL PACIFIC. F. G. Lowman (Univ. of Washington, Seattle). p.145-9 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Three factors appeared to control the selective uptake of radionuclides from sea water by the plankton, omnivorous fish, and carnivorous fish studied. These were isotope dilution by the corresponding stable element or chemically similar element in the sea water, the tendency of divalent cations to complex strongly with biological substrates, and the biological requirements for certain elements in metabolic processes. During the first 48 hours following fallout the plankton in the contaminated area accumulated radionuclides in approximately the same ratio as they occurred in sea water. After one week the radioisotopes of the three elements cobalt, iron, and zinc were actively taken up by the plankton in comparison to the other radionuclides which were associated with the plankton at percentages similar to those in sea water. Omnivorous fish which feed on the plankton, almost completely excluded the fission products and, on a comparative basis, concentrated zinc-65 and iron-55, -59, but discriminated against cobalt-57, -58, -60. Carnivorous tunas, which feed primarily on omnivorous fishes, discriminated in favor of zinc and manganese and against iron and cobalt in comparison to the relative percentages of these radionuclides in their food supply. (auth)

33557 RADIOACTIVITY OF MARINE ORGANISMS FROM GUAM, PALAU AND THE GULF OF SIAM, 1958-1959. Allyn H. Seymour (Univ. of Washington, Seattle). p.151-7 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Following the Hardtack weapons test series at Bikini and Eniwetok in 1958, samples of fish, crabs, lobsters, snails, clams, algae, and plankton were collected at Guam, Palau, and in the Gulf of Siam for radiological analyses. The collecting areas were 1,200, 1,950, and 4,250 miles, respectively, west of the test site. The gross beta activity was determined for all samples and the gamma-emitting nuclides were identified in selected samples. The rate of westward transport of local fallout from the Hardtack series by the North Equatorial Current was estimated at eight miles per day between the test site and Guam and Palau. The criterion for the arrival of the fallout at the collecting area was a significant increase in the gross beta count of certain biological samples. The levels of radioactivity were considerably different for samples from the three collecting areas: the counts of samples from Guam were notably higher than those from Palau, which in turn were very much higher than those from the Gulf of Siam, which were essentially at background level for all collections. The gross beta counts of fish muscle from all areas and from all collections were constant and less than seven micromicrocuries per gram of wet weight. The samples with the highest gross beta counts were clam kidney and spider snail liver, with maximums of 204 and 356 micromicrocuries per gram, respectively. Gross beta counts of some Guam and Palau samples prior to the arrival of the Hardtack fallout indicate the presence of radionuclides from prior test series. Gamma-emitting nuclides other than naturally occurring potassium-40 included, in order of abundance, cobalt-57, cobalt-60, manganese-54, cerium-144, zinc-65, and silver-110m. The greatest value was 2,300 micromicrocuries per gram of wet weight for clam kidney (Tridacna). The occurrence of silver-110m in the liver of the spiny lobster was of special interest because it is a previously unreported fallout nuclide and so far has been detected only in spiny lobster. (auth)

33558 ZINC-65 IN OYSTERS IN FISHERS ISLAND SOUND AND ITS ESTUARIES. Bryant W. Fitzgerald and Donald M. Skauen (Univ. of Connecticut, Noank). p.159-62 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

An investigation was undertaken to establish the amounts of zinc and the background levels of zinc-65 in shellfish from Fishers Island Sound and its estuaries. An evaluation of several genera of mollusks indicated that the shellfish most suitable for the purpose was the edible oyster (Crassostrea virginica). The samples which were collected on a routine schedule from May 1960 to July 1961, were all from oyster beds located in the Thames River (Connecticut). In a few instances samples were collected from other areas and the results obtained were used for comparative purposes. It was shown that the zinc content of oysters from a given locale varies considerably. It was further established that the background levels of zinc-65 are not static. The year-long study showed a peak value from February to May of 1961 and a sharp increase during the month of June and continuing. These results were observed during the same season the previous year. The rate and extent of zinc-65 uptake by oysters were observed in the laboratory. A variety of zinc-65 salts was administered and the effect of the various anions noted. In one instance, the zinc-65 was complexed with a commercially available complexing agent. The addition of zinc-65 labeled salts to oysters grown in contained sea water demonstrated that a considerable amount of the zinc-65 became associated with the shells of the organisms and that a limit to the amount of zinc-65 taken up by the oysters was reached within the first 24 hours of the experiment. Complexation of the radioactive ion had a considerable effect on the rate and extent of zinc-65 uptake by the tissue. Of equal importance was the observation that complexation of the ion virtually eliminates all association between the ion and the shells. (auth)

33559 EXPERIMENTAL STUDIES OF THE TURNOVER OF PHOSPHATE IN MARINE ENVIRONMENTS. Lawrence R. Pomeroy (Univ. of Georgia, Athens). p.163-6 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The addition of methylene blue and cyanide to natural waters blocks the short-term turnover of phosphate between water and suspended solids. The turnover is therefore believed to involve biological processes, probably phosphorylation. In darkness the turnover rate of phos-

phate is sometimes reduced. This suggests that photosynthetic organisms can play a significant role in phosphate turnover, perhaps in proportion to their abundance. The addition of antibiotics to sea water and estuarine water may inhibit the release of phosphate from suspended solids, but often it has little effect. Therefore, the role of bacteria in phosphate turnover may vary greatly, and it may depend on the size or character of the bacterial flora. (auth)

33560 QUALITATIVE DISTRIBUTION OF RADIONUCLIDES AT RONGELAP ATOLL. E. E. Held (Univ. of Washington, Seattle). p.167-9 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The qualitative distribution of radionuclides at Rongelap Atoll as determined approximately five years after contamination by fallout from a thermonuclear device indicates distinct differences between the terrestrial and marine environments. The levels of radioactivity are low, the concentrations being less than the maximum permissible concentration for radionuclides in food or drinking water of man. Of the wide spectrum of radionuclides concentrated in the surface layers of the soil, strontium-90, antimony-125, and cesium-137 are the principal nuclides entering into the soil solution. The principal nuclides in the land plants and plant-eating animals such as coconut crabs and the indigenous rats are cesium-137 and, to a lesser degree, strontium-90. Bottom sediments contain mainly strontium-90 and europium-155. The radionuclides in the lagoon water have not been detected but are probably present in minute amounts. Planktonic organisms contain traces of manganese-54, cobalt-57, 60, zinc-65, zirconium-95, ruthenium-106, and cerium-144. The principal nuclide found in the marine algae is cerium-144. In the marine invertebrates cobalt-60 and zinc-65 occur most commonly. Corals and coralline algae contain some strontium-90, while the fish and sea birds are found to contain mostly zinc-65. The presence of zinc-65, cesium-137, and strontium-90 in the body of the natives reflects a diet of both marine and terrestrial origin. (auth)

33561 AVAILABILITY OF SEDIMENT-SORBED MATERIALS TO MARINE BIOTA. T. W. Duke, E. R. Ibert, and K. M. Rae (Agricultural and Mechanical Coll., College Station, Tex.). p.171-4 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The retention of sorbed radioactive contaminants by clay minerals in a marine environment and the availability of sediment-sorbed materials to marine biota were investigated in laboratory experiments. The activities of C^{14}-labeled organic materials sorbed on montmorillonite were measured after incubation for 7 days with marine bacteria isolated from surface and bottom samples collected in the Gulf of Mexico. Results showed that C^{14} in the organic material sorbed on clay was available to the bacteria and evolved as $C^{14}O_2$. Fish, shrimp, and oysters exposed to an environment containing organic material labeled with C^{14}, $Cs^{137}Cl$, or $Ca^{45}Cl_2$ concentrated Cs^{137} and Ca^{45}, while a dilution of C^{14} was observed. Scavenging of the three isotopes by clay particles was not demonstrated. (C.H.)

33562 MICRO-ORGANISMS IN ENVIRONMENTS CONTAMINATED WITH RADIOACTIVITY. James B. Lackey (Univ. of Florida, Gainesville) and Carrie F. Bennett. p.175-7 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Results from both field and laboratory observations show that microorganisms do not distinguish between stable and radioactive nuclides. In the field, as well as in laboratory experiments, occurrence of microorganisms is the same in a radioactive environment as in a similar but non-radioactive environment. No change in behavior, morphological or physiological, of the microorganisms was observed, using either gamma or alpha and beta sources of radiation. Exposure to gamma radiation had no effect immediately in over 60 generations on the division rate of Entosiphon sulcatum. So it seems that these changes are either lacking, few, or are not detectable. (auth)

33563 THE ROLE OF PHYTOPLANKTON IN THE CYCLING OF RADIONUCLIDES IN THE MARINE ENVIRONMENT. T. R. Rice (U. S. Bureau of Commercial Fisheries, Beaufort, N. C.). p.179-85 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The importance of phytoplankton in passing radionuclides up the food chain depends upon the number and amount of radionuclides accumulated, the length of time these radionuclides are retained by the phytoplankton, the size of the phytoplankton cells and the number of cells present in the water, and the efficiency of digestion of the cells by filter-feeding animals. It was shown both in the laboratory and under field conditions that phytoplankton accumulate a large number of elements from sea water and are, therefore, very important in the removal of radionuclides and in the cycling of radionuclides in the oceans. (C.H.)

33564 THE UPTAKE, ACCUMULATION AND EXCHANGE OF STRONTIUM-90 BY OPEN SEA PHYTOPLANKTON. E. F. Corcoran and J. F. Kimball, Jr. (Univ. of Miami, Florida). p.187-91 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Five cultures of oceanic phytoplankton were used to determine their ability to concentrate Sr^{90} from sea water. The experiments were short-termed and conducted during the active growth phases to eliminate the possibility of nutrient deficiencies and over-population, to minimize bacterial interference, and to emulate natural conditions as closely as possible. All cells grown in media containing Sr^{90}-Y^{90} became radioactive. The uptake of strontium by the cells was proportional to the concentration of strontium which was added. The cells were able to concentrate the radioactive strontium from 18.6 to 381.7 times the concentration in the media. Cell growth in media containing up to ten times the normal concentration of strontium was not inhibited. High concentrations of strontium in the media had little effect on the ability of cells to accumulate strontium-90. Adsorption was found to play an important role in the accumulation of strontium-90. While these results are preliminary in nature it is important to note that the primary producers in the sea are capable of accumulating strontium-90 from sea water. Controlled laboratory experiments have the advantage of allowing comparisons between various phytoplankton and radionuclides. (auth)

33565 THE EFFECT OF ENVIRONMENTAL IONS ON THE CONCENTRATION OF RADIOCALCIUM AND RADIOSTRONTIUM BY EURYHALINE TELEOSTS. Sidney J. Townsley (Univ. of Hawaii, Honolulu). p.193-9 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Euryhaline fish (Tilapia mossambica) exposed for two weeks to fresh water, fresh water plus added calcium, and

sea water containing equal concentrations of strontium-89 show concentrations of the nuclide in their tissues in inverse order to the calcium plus strontium, but not directly related to the absolute amounts of the ions. Although 50 times more stable calcium is present in salt water, the amount of strontium-89 retained in the tissues was not 50 times greater in salt-water fish. It is assumed that the Sr^{2+} in the environments cannot account for the differences. Exposure of T. mossambica to fresh waters and sea waters with varying concentrations of Ca^{2+} and Sr^{2+}, and ratios of these ions to one another, show that radiocalcium and radiostrontium accumulation and retention are controlled by several factors, such as the total divalent ions present, as well as other salts in the environment. The effects of increased concentrations of Sr^{2+} in the environment have little effect upon the total radioactive calcium plus strontium absorbed, nor upon their ratio. It would appear, therefore, that for decontamination of aquatic environments addition of calcium salts and other divalent ions could be more effective against absorption of radiocalcium and radiostrontium than addition of Sr^{2+} alone. It does not appear that release of radiocalcium or radiostrontium into marine or brackish environments would result in as much absorption and retention of radioactive strontium or calcium as in fresh water environments. This is particularly important to the species which show migratory or osmotic regulation habits. Thus under differing environmental conditions, the same species of fish may show varying degrees of accumulation and retention of radiocalcium and radiostrontium. (auth)

33566 THE STRONTIUM AND CALCIUM RELATIONSHIPS IN CLINCH AND TENNESSEE RIVER MOLLUSKS. D. J. Nelson (Oak Ridge National Lab., Tenn.). p.203-11 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The shells of a number of species of clams from the Clinch and Tennessee Rivers were analyzed for calcium, strontium, and strontium-90 to determine the content of these elements and this isotope of strontium as a function of species and location in the river, and whether they could be used as biological indicators of strontium-90 in the water. The calcium content of the shells was relatively constant and constituted 40 per cent of the shell ash weight as would be expected with calcium carbonate. The average strontium content of shells of different species of clams ranged from 156 to 382 micrograms per gram. The differences in strontium content are due to inherent differences between species rather than to the strontium to calcium ratio in the environment. Two factors which appear to affect strontium deposition in clam shells are growth rate and surface to volume relationships. The strontium content of clam shells increases with growth rate and with a reduced surface to volume ratio. These factors do not explain the strontium content of all species, and the inherent species differences may be related to the nonhomogeneous distribution of strontium within the clam shells. Probable reasons for the lower strontium to calcium ratios obtained in this study compared to the ratios reported by others are differences in species and populations analyzed, environmental ratios, and errors in strontium determination. However, this is not an unequivocal explanation. The low-level releases of strontium-90 were used as a tracer to determine the behavior of strontium-90 released to the Tennessee River system. There was a very good agreement between the strontium-90 to stable strontium atom ratios observed and expected in clam shells on the basis of dilution of Clinch River water by Tennessee River water. This agreement suggests that clams may be used as samplers of strontium-90 and that strontium-90 released to the Clinch River is in equilibrium with the living and nonliving components of the river system. Concentrations of strontium-90 in the Tennessee River will be directly related to dilution of the contaminated water by noncontaminated water. (auth)

33567 NATURAL RADIOACTIVITY IN THE FOOD WEB OF THE BANDED SCULPIN COTTUS CAROLINAE (GILL). W. L. Minckley, J. E. Craddock, and L. A. Krumholz (Univ. of Louisville, Kentucky). p.229-36 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Measurements were made of the natural radioactivity of the carnivorous fish, Cottus carolinae, or bonded sculpin, collected in Doe Run, a spring stream in Meade County, Ky., in 1959. This study was part of a study of the relationships between animals and plants in the stream and their physical and chemical environment. Most of the radioactivity in Doe Run results from natural decay of U^{238} and Th^{232}, as determined by detection of Bi^{214} and Ac^{228} on a γ spectrometer. Small amounts of Sr^{90} and Cs^{137} from fallout were also present. The food habits and ecological relations of Cottus carolinae are reviewed. The passage of radioactivity through the food chain of C. carolinae was found to involve concentration of radioactivity at the producer level, with varied amounts of accumulation or discrimination at higher tropic levels involving animals. The producers were found to accumulate radioactivity from the low average amount present in the stream by factors of 170 to 1,800. Smaller invertebrates, comprising the primary and secondary consumer levels, generally contained amounts of radioactivity that were from 0.5 to 2.0 times that of their foods. The amount of radioactivity per gram of food ingested by Cottus was found to decrease with age through a change in feeding habits as the fish increased in size. (C.H.)

33568 RADIUM IN NATURAL WATERS IN THE UNITED STATES. Robert C. Scott (U. S. Geological Survey, Washington, D. C.). p.237-40 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Results are reported from a survey of major aquifers in the U.S. which yield high-radium water. The geographic and stratographic extents of 3 aquifers are discussed in detail. These sources are used primarily for stock, irrigation, and industrial supplies. Potential dangers from the consumption of water from these aquifers by man are discussed. (C.H.)

33569 ECOLOGICAL EFFECTS OF IONIZING RADIATION ON ORGANISMS, COMMUNITIES AND ECOSYSTEMS. Robert B. Platt (Emory Univ., Atlanta). p.243-55 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The effects of radiation on organisms, communities, and ecosystems are reviewed. Data are presented from studies conducted around the air-shielded Lockheed-Air Force reactor in north Georgia. Trees and other vegetation were exposed to radiation doses ranging from near lethal to background levels. Broad-scale effects of radiation on forest trees are enumerated. (C.H.)

33570 CHANGES IN A HERBACEOUS PLANT COMMUNITY DURING A THREE-YEAR PERIOD FOLLOWING EXPOSURE TO IONIZING RADIATION GRADIENTS. Frank McCormick (Emory Univ., Atlanta). p.271-6 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The effects of radiation from a γ source on natural herbaceous plant communities were analyzed. Weekly measurements and observations were made of germination, growth, survival, periodicities, frequency, and abundance of plants for each quadrant. A photographic record was also made. The immediate and long-range effects of ionizing radiation upon individual species and community attributes in all seasonal floras are described. Data indicate that γ radiation has both stimulatory and inhibitory effects upon plant growth and survival and that these ecological, morphological, and physiological effects are reflected by species interactions at the community level. (C.H.)

33571 STUDY OF SUCCESSION IN FIELDS IRRADIATED WITH FAST NEUTRON AND GAMMA RADIATION. Charles P. Daniel (Emory Univ., Atlanta). p.277-82 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Plant succession is described for a flood plain field in Dawson County, Georgia, abandoned after corn harvest in 1956 and subjected to intermittent neutron and γ radiation from an air-shielded nuclear reactor since the spring of 1959. A flood plain community of Monarda–Smilax, last planted in corn in 1956, and located 2 miles northwest of the reactor was used as a control area. Environmental analysis showed that the control field and the irradiated field were much alike in seed source, temperature, rainfall, water-table level, available light, pH, soil profile, and root position. Species found on irradiated and control field quadrants are listed and changes in dominance patterns are described. Gamma-neutron irradiation of 28,500 to 44,500 rads/year resulted in reduction of the standing crop and eliminated some species, but did not destroy all vegetation. (C.H.)

33572 EFFECTS OF RADIATION FROM AN AIR-SHIELDED REACTOR ON FOREST LITTER PRODUCTION. John T. McGinnis (Emory Univ., Atlanta). p.283-7 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Observations made during a two-year period, 1959 to 1960, in 5 oak-hickory stands exposed to mixed neutron-γ radiation from an air-shielded reactor near Dawsonville, Georgia, indicated that relatively high radiation doses brought about pronounced effects upon the time litter released from forest communities, the total amount of litter contributed to the forest floor, and the amount of leafy and non-leafy litter material produced. A radiation dose of 15,000 rads during the summer caused initiation of litter fall 7 weeks early in the autumn and almost complete inhibition of leaf production the next spring. (C.H.)

33573 THE EFFECT OF IONIZING RADIATION ON SMILAX WITH SPECIAL REFERENCE TO THE PROTECTION AFFORDED BY THEIR PRODUCTION OF UNDERGROUND VEGETATIVE STRUCTURES. Hedley G. Chappell (Emory Univ., Atlanta). p.289-94 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Quadrant sampling of populations of two species of Smilax growing on a flood plain exposed to mixed neutron and γ radiation from an air-shielded reactor showed the number of both old and new shoots to be markedly reduced after exposure to 32,000 rads radiation. The plants were able to produce new shoots despite the fact that stolons above 11 cm in the soil were inactivated. The cryptophytic life form possessed by Smilax enabled plants to survive environmental doses of ionizing radiation many times that which would be lethal if delivered to their tissues. The protective effects of soil against radiation injury of underground buds are discussed. (C.H.)

33574 EFFECTS OF IONIZING RADIATION ON PINUS TAEDA L. Robert A. Pedigo (Emory Univ., Atlanta). p.295-9 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Between June 1959 and November 1960, some of the effects of ionizing radiation on loblolly pine were investigated. Discoloration, death of terminal buds, and inhibition of reproduction occur after exposures of 1,000 to 2,000 rads. Accumulation of greater doses results in complete browning, defoliation, and death. The lethal dose is about 7,500 rads. Terminal and radial growth exhibit a differential radiosensitivity, the former inhibited by about 1,000 rads and the latter requiring 3,000 to 4,000 rads for inhibition. In addition terminal buds are differentially affected, depending on whether or not they occur on terminal or lateral shoots. These relationships suggest a physiological basis for radiosensitivity based on auxin metabolism or factors correlated with auxin metabolism. In general, the results observed indicate that ionizing radiation of relatively low doses will greatly hinder the success of loblolly pine in its normal habitat. (auth)

33575 FACTORS AFFECTING TREE SEED AND SEEDLING RADIOSENSITIVITY. Margaret B. Heaslip (Morehead State Coll., Morehead, Ky.). p.301-6 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Increasing the water content increases the radiosensitivity of Quercus alba L. seed which is physiologically active from the time it ripens. Water content, physiological activity, and radiosensitivity of Quercus velutina Lam. and Juglans nigra L. seed increase as embryo dormancy is broken during stratification. In contrast, the radiosensitivity of dormant Quercus velutina Lam. and Juglans nigra L. seed has an inverse relationship to the seed water content. Water seems to increase seed radiosensitivity indirectly by affecting the rate of physiological activity in these species. The radiosensitivity of year-old seedlings of Quercus alba L., Q. velutina Lam., and Liquidambar styraciflua L. did not vary significantly from species to species. Physiologically active seedlings of each of these species were not significantly more radiosensitive than dormant seedlings of the same species. At the levels tested, seed radiosensitivity of these species could not be used as an indicator of seedling sensitivity. (auth)

33576 RECOVERY OF VEGETATION ON ATOMIC TARGET AREAS AT THE NEVADA TEST SITE. Lora Mangum Shields and Philip V. Wells (New Mexico Highlands Univ., Las Vegas). p.307-10 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

A typical nuclear detonation at the Nevada Test Site, an airburst of a 20- to 40-kiloton yield, denuded a zone of

desert shrub vegetation about 0.5 mile in radius. Asymmetric blast damage to shrubs extended to a greater distance, in some cases to beyond one mile, varying with species and stability of the substratum. Gross injury to vegetation appears to be largely from blast and thermal effects. The spring following denudation, ground cover by annuals between 0.4 and 0.8 mile from different ground zeros exceeded total cover in the control vegetation. Beyond the perimeter of denudation, recovery is evident in the crown sprouting of several shrub species, in the appearance of weedy perennials, and in the prominence of bunchgrasses. During a four-year study period (1957 through 1961) it has not been possible to establish an unequivocal relation between killing, injury, or morphological aberration in vegetation and ionizing radiation from nuclear detonations. (auth)

33577 RADIATION DOSAGES IN THE VICINITY OF AN UNSHIELDED NUCLEAR REACTOR. James J. Cowan and Robert B. Platt (Emory Univ., Atlanta). p.311-18 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The radiation dose in the vicinity of an unshielded nuclear reactor located in a remote, heavily wooded area near Dawsonville, Georgia, was measured for varying reactor operations. The effect of terrain and vegetation on dosages was determined. Neutrons were found to be proportionally attenuated more than γ radiation by vegetation. (C.H.)

33578 INFLUENCE OF FOUR ROCKY MOUNTAIN REGIONAL ENVIRONMENTS ON PEA PLANTS GROWN FROM IRRADIATED SEEDS. William S. Osburn, Jr. (Univ. of Colorado, Boulder). p.319-24 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

During the summer of 1960, dry pea seeds were irradiated at dose levels of 0, 100, 500, 1,000, and 5,000 rads. They were then planted in essentially the same manner in each of four experimental plant gardens, located adjacent to regional environmental measurement stations at 7,300, 8,500, 10,000, and 12,300 feet in altitude on the east slope of the Colorado Front Range west of Boulder, Colorado. Total height of the peas was measured at intervals throughout the summer. These data were then correlated with the environment as determined from the adjacent environmental measurement stations. Comparisons revealed that growth after identical radiation dosages varied from much less (dwarfed) to significantly greater (stimulated) than that of the controls, depending upon the type of post-irradiation environment. (auth)

33579 NATURAL RADIATION EFFECTS OF VERTEBRATE ANIMALS INHABITING THE URANIUM AREAS OF SOUTHEASTERN UTAH. Wilmer W. Tanner (Brigham Young Univ., Provo, Utah). p.325-6 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Preliminary data are reported from a survey of vertebrate populations in an area of the Upper Colorado River Basin in Southeastern Utah where the ground radiation dose from uranium deposits is 20 or more μr/hr. Emphasis was placed on lizards and small mammals. The data will be used to study the effects of chronic radiation exposure on genetic variation in the populations. (C.H.)

33580 COMPARATIVE ECOLOGICAL STUDIES OF ANIMALS AT THE NEVADA TEST SITE. Dorald M. Allred and D. Elden Beck (Brigham Young Univ., Provo, Utah). p.327-31 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Data are presented from a comparative ecological study of native fauna of the Nevada Test Site, Nye County, Nevada. Preliminary data are included on the effects of nuclear detonations on animal populations in this area. (C.H.)

33581 EFFECTS OF IONIZING RADIATION ON MAMMAL POPULATIONS ON THE WHITE OAK LAKE BED. Paul B. Dunaway and Stephen V. Kaye (Oak Ridge National Lab., Tenn.). p.333-8 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

No effects attributable to ionizing radiation were detected during a study of small-mammal populations on the dry bed of the former White Oak Lake, which had been contaminated with radioactive waste, and an uncontaminated old field. Succession on both areas seemed normal, the populations of both areas were decimated during the winter of 1959–60 and the incidence of injuries and abnormalities in cotton rats on both areas was about the same. Male cotton rats and rice rats were trapped on the lake bed in significantly greater numbers than the females, breeding continued longer in cotton rats on the old field in 1959, and average litter size of cotton rats on the lake bed was smaller than the average litter size on the old field. Residence time of cotton rats on the lake bed was longer than on the old field, and the incidence of pathological conditions in white-footed mice from uncontaminated areas was greater than in the same species from contaminated areas. (auth)

33582 THE EFFECT OF NEUTRON-GAMMA RADIATION ON FREE-LIVING SMALL MAMMALS AT THE LOCKHEED REACTOR SITE. Jay H. Schnell (Emory Univ., Atlanta). p.339-44 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

A study was made of the effects of neutron and gamma radiation on populations of the white-footed mouse (Peromyscus leucopus), the beach mouse (Peromyscus polionotus), and the cotton rat (Sigmodon hispidus) living in a 34-acre old-field and adjacent woods. The radiation source was an air-shielded reactor located at Air Force Plant 67, Dawsonville, Georgia. Between August 1 and 21, 1960, the environment was subjected to intense radiation. A technique of introducing populations of cotton rats onto the study area prior to reactor tests proved to be highly successful for providing an experimental group of non-irradiated animals and for temporarily increasing the population density. Pre-baited live traps provided adequate sampling devices since animals continued to come to traps even in advanced stages of radiation sickness. An average environmental dose of 4,308 rads (about seven times an estimated lethal dose-50) delivered over a five-day period completely exterminated a population of 11 introduced cotton rats. On the other hand an average environmental dose of 5,693 rads (about seven times lethal dose-50) delivered over a period of 15 days resulted only in a 38 per cent disappearance of resident individuals of the two species of Peromyscus. White-footed mice living in the open field all disappeared, but at least some of the beach mice in the field survived as did some white-footed mice living in the woods. Habitat shielding was estimated to have reduced the environmental dose 77 per cent in the case of the cotton rat and 88 per cent for Peromyscus. The beach mice, because of their deep burrowing habits, were

probably the most shielded of the three species; cotton rats which live largely above ground were the least shielded. Surviving white-footed mice living in the wooded area showed zero to five per cent greying of the pelage after several weeks. The accumulated radiation field in their habitat was estimated to be 11 times their lethal dose-50. The beach mice surviving in the open field showed 53 to 100 per cent pelage greying after their habitat had been irradiated with 15 times their lethal dose-50. A total of eight mammals (six Peromyscus and two Sigmodon hispidus) showed pelage greying presumably due to exposure to radiation. The body dose estimated to have been received by the two grey Sigmodon was on the order of 200 to 400 rads. Pelage greying was observed two to four months after radiation exposure in Peromyscus. One greying individual captured two months after irradiation of the habitat was kept in the laboratory; by five months it was completely white. The following behavioral effects were observed in irradiated cotton rats living free in the field: lack of aggressiveness and alertness, impairment of motor reflexes and equilibrium, and a general reduction in activity without, however, any marked reduction in appetite. When these abnormalities were all present in an individual, it was never again recaptured. (auth)

33583 RELATIVE SENSITIVITY OF NESTLINGS OF WILD PASSERINE BIRDS TO GAMMA RADIATION. William K. Willard (Univ. of Georgia, Athens). p.345-9 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Two or three nestling bluebirds (Sialia sialis) or crested flycatchers (Myiarchus crinitus) were removed from nest boxes located within the U. S. Atomic Energy Commission's Savannah River Plant reservation, one or two of which were irradiated by a cobalt-60 source while the remaining nestmate sibling served as a non-irradiated control. All nestlings were returned to the box as soon as possible and their development to the fledging stage observed under natural conditions of care by their parents. Nestlings were irradiated at either two days of age (cold-blooded stage) or nine days (warm-blooded stage) with single acute doses ranging from 100 to 3,000 roentgens. The lethal dose for both ages of bluebirds was 3,000 roentgens and the estimated lethal dose-50 for the 16-day nestling stage about 2,500 roentgens. However, severe stunting effects on growth and feather development occurred at much lower doses, reducing the chances of survival in transition from nestling to the fledging stage. Nestlings irradiated at two days old at the level of 300 to 500 roentgens were smaller and had on the average shorter primary feathers at the time of normal fledging by about an average of 10 per cent as compared with control nestmates. These differences were statistically significant. At 1,500 or 2,000 roentgens the stunting of growth and feather development averaged more than 50 per cent. From the data at hand it was estimated that the lethal dose-50 for transition from nestling to fledgling stage would be about 500 or 600 roentgens (or about one-fifth the lethal dose) for birds irradiated early in development. Effects were less severe in nine-day birds since weight gains and feather development were well along by this age; however, shortening of primary feathers occurred at the higher doses (about $\frac{2}{3}$ feather elongation occurs after nine days). One nine-day bird irradiated at 500 roentgens was known to survive to adulthood and to breed normally the following year. Nestling bluebirds living under natural conditions proved to be more resistant to gamma radiation than young chickens. Preliminary data on the crested flycatcher suggested, but did not prove, that nestlings of this species were more sensitive than bluebirds to the lower levels of gamma radiation (300 to 600 roentgens). All nestlings which survived irradiation developed normal fledging behavior and attempted to leave the nest box along with normal young even when growth and feather development were greatly stunted. Nestlings receiving up to 800 or 900 roentgens at two days of age were usually able to leave the nest at the normal time, but, as indicated above, their chance of survival during the critical fledging period was reduced by their weakened condition and subnormal flying ability. After receiving 1,500 roentgens nestlings were usually able to climb out of the nest box at fledging time but were unable to fly even though they made every attempt to do so when the normal siblings fledged. It was clear that while sub-lethal doses markedly affected the growing tissues of the body and feather follicles, such doses did not affect the brain centers responsible for the development of ontogenetic behavior patterns. (auth)

33584 INCREASE IN RADIORESISTANCE OF FISH TO LETHAL DOSES WITH ADVANCING EMBRYONIC DEVELOPMENT. Kelshaw Bonham and Arthur D. Welander (Univ. of Washington, Seattle). p.353-8 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Experimental data and analysis of published results indicate that the radioresistance of the embryos of fishes and amphibia increases with advancing development in a way that may be expressed mathematically. Eggs of silver salmon were x irradiated in 23 stages of development randomly selected from one-cell to late-eyed stage, at each stage using seven dosages incremented by a factor of about two. Lethal dose-50's at hatching and at 150 days post-fertilization were both calculated and estimated from graphs. The regression of log lethal dose-50 in roentgens upon log percentage of incubation attained at time of irradiation was computed at both hatching ($Y = 240\ X^{0.42}$) and at 150 days ($Y = 125\ X^{0.33}$). These regression coefficients (the exponents of X) had confidence limits determined by $t_{.05}{}^{5}b = 0.194$ and 0.188, with 18 and 19 degrees of freedom, respectively. The regressions represent general trends rather than the most sensitive stage. Estimates from the literature give similar relationships for rainbow trout, Fundulus and Misgurnus, although the regression for Misgurnus was nonsignificant. Amphibian radioresistance increased very slowly from fertilization to neurulation, and then sharply from neurulation almost to metamorphosis. (auth)

33585 THE PRELIMINARY INVESTIGATION OF SALIVARY GLAND CHROMOSOMES OF CHIRONOMUS TENTANS FABR. FROM THE CLINCH RIVER. D. J. Nelson and B. G. Blaylock (Oak Ridge National Lab., Tenn.). p.367-72 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Some of the Chironomus tentans Fabr. larvae collected from White Oak Creek and the Clinch River have unusual forked preanal gills. A subsequent cytogenetic study showed the salivary gland chromosomes of the C. tentans population contain what appears to be a relatively high frequency of chromosomal aberrations. Twenty-three individuals in a sample of about 300 were found which had three chromosomes each instead of the usual four. These populations from areas contaminated with radioactive waste effluents have not been compared with other local populations not ex-

ination, had significantly higher levels than jack rabbits from other onsite stations. Average strontium-90 concentration of 1960 jack rabbit bones were lower than the 1958 and 1959 rabbits by a factor of two. Classification of the jack rabbits into three year-of-birth groups increased the accuracy of the jack rabbit as a bio-indicator of strontium-90. (auth)

33597 BIOLOGICAL AND PHYSICAL TRANSPORT OF RADIONUCLIDES IN STRATIFIED LAKES. Arthur D. Hasler and Gene E. Likens (Univ. of Wisconsin, Madison). p.463-70 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Tracer techniques are described that were developed for use in studies of biological transport of nutrients within lakes, their metabolism in aquatic ecosystems, and to trace the physical movement of the water itself. Data are reported from studies of a small chemically stratified lake and water movement and ion transport in an ice covered lake. (C.H.)

33598 USE OF LIGHT NUCLIDES IN LIMNOLOGY. Edward S. Deevey, Jr., Minze Stuiver, and Noboyuki Nakai (Yale Univ., New Haven). p.471-5 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Results are reported from measurements of the distribution of C^{13}, C^{14}, and S^{34} in lakes. Isotopic fractionation during biological oxidation and reduction reactions and applications of the data in measuring rates of metabolism in a self-contained ecosystem are discussed. The contribution of C^{14} from fallout, groundwater, and aquatic plants to levels in lake waters is considered. A scheme is included for the carbon cycle in a dimictic lake, based on C^{13} assays. Possible mechanisms contributing to sulfur enrichment in lakes are reviewed. (C.H.)

33599 EVALUATION OF THE CARBON-14 TECHNIQUE FOR MEASUREMENT OF PRIMARY PRODUCTION. M. B. Allen (Kaiser Foundation Research Inst., Richmond, Calif.). p.477-80 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The C^{14} technique for measurement of primary productivity is based on the assay of the amount of inorganic C converted into organic form by the photosynthesis of natural phytoplankton populations. Methodological problems associated with the technique are discussed. It is concluded that the method is the best currently available for use in studies of phytoplankton ecology. (C.H.)

33600 USE OF NITROGEN-15 FOR MEASUREMENT OF RATES IN THE NITROGEN CYCLE. John C. Neess (Univ. of Wisconsin, Madison), Richard C. Dugdale, John J. Goering, and Vera A. Dugdale. p.481-4 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Applications of N^{15} as a tracer for measurements of the rate of nitrogen fixation in lake waters are described. The same technique may be used to measure denitrification and the assimilation of ammonia or nitrate. The role of biota in delivering fixed nitrogen to lake waters and the uptake of free nitrogen by lake waters are discussed. (C.H.)

33601 ZINC-65 IN STUDIES OF THE FRESHWATER ZINC CYCLE. Roger W. Bachmann (Univ. of Michigan, Ann Arbor). p.485-96 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Zinc-65 was used in studies of factors that affect the distribution of Zn between the water and various solid materials in lakes. A theoretical outline is presented of the freshwater Zn cycle which is characterized by exchanges between dissolved Zn and various organic and inorganic suspended materials, as well as rooted aquatic plants and bottom sediments. (C.H.)

33602 MANGANESE IN ECOLOGY. Peter J. Wangersky (Yale Univ., New Haven). p.499-508 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

A simplified diagram is presented of the manganese cycle in nature. The isotopes of Mn and their half-lives are listed. Observations on the geochemical cycle of Mn, based on Mn^{55} distribution, are presented. Topics discussed include the distribution of Mn in igneous rock, in the soil, in plants and animals, in fresh water, in sea water and in sediments. The origin of Mn nodules found in deep water is discussed. The distribution of artificially produced radioisotopes of Mn in nature is considered. (C.H.)

33603 BIOLOGICAL AND ENVIRONMENTAL BEHAVIOR OF RUTHENIUM AND RHODIUM. S. I. Auerbach and J. S. Olson (Oak Ridge National Lab., Tenn.). p.509-19 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Many analytical and physiological data have been taken to imply a low biological availability of ruthenium and rhodium. Yet ruthenium-103 and Ru^{106}–Rh^{106} must be considered among the more important environmental contaminants because of their relatively high yield from fission and their moderately long half-lives. Furthermore, because our knowledge of the biological and environmental behavior of the several complexes of ruthenium is meager, it is possible that the environmental mobility and hazards have been underestimated. Most experiments have utilized the valence III and IV states of ruthenium, whereas radioruthenium in waste effluents will be in more complex forms, depending upon the chemical composition of the waste and the environment. Experiments involving waste effluents and nitrosyl compounds of ruthenium, which are formed in the common types of radioactive waste, have shown that these compounds may be taken up in greater quantities or behave differently when released into environmental situations. These differences in behavior which may be attributable to the various chemical forms of ruthenium impose a need for further investigations, particularly of a comparative nature, which take these complex forms into account. Near industrial sources, levels of ruthenium radioisotopes may rise well above the levels contributed by atmospheric fallout, barring outbreak of nuclear war. While fallout levels have been too low to permit analyses of the chemical form of ruthenium present, increased levels due to resumption of weapons testing may present an opportunity for obtaining such information. In the event of nuclear war, ruthenium radioisotopes could be one of the most significant contributors to gamma radiation from local and world-wide fallout during the first year or so following the detonation of nuclear weapons. Regardless of origin, the instability of ruthenium compounds in changing environments will require the utmost care in interpretation of biological and environmental behavior of ruthenium. (auth)

33604 THE RADIOECOLOGY OF CALCIUM. Sidney C. Hsiao (Univ. of Hawaii, Honolulu). p.525-32 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

A brief review is presented of the ecology of calcium. A list is given of the source references that provide coverage of different segments of the literature on various aspects of the ecology of calcium. A few interesting problems in the ecology of calcium which need further investigation mentioned include the problem of the inorganic formation and transformation of calcium compounds; the basic mechanism of organic deposition of calcium salts; and the complexity of calcium deposition and its relationship with plant and animal distribution and productivity. Several physiological problems also deserve study. These include the physiology of skeleton formation, in addition to its participation in the skeletal system, in various species, and the availability for exchange between calcium in circulation and that in the gastro-intestinal tract. The use of calcium-45 in sea urchin has shown that there is an interchange of calcium between the unfertilized eggs and the environment. The fertilized eggs accumulate calcium as they develop into plutei. The source of the calcium seems to be the ambient sea water, while calcium in the food is not as important for the supply of calcium. In the process of calcium uptake the cortical region of the unfertilized egg, the zygote, or the blastomeres is the first station for accumulation. With further development the calcium is transported by the processes of gastrulation and primary mesenchyme formation to the interior of the embryos where later the mesenchyme cells transmit the calcium to the spicules. Temperature exerts a definite influence on the uptake of calcium by sea urchin embryos and the optimum temperature for the ionic uptake among subtropic sea urchins in the Mid-Pacific is about 30° centigrade. At 10° centigrade uptake of calcium is blocked. The sea urchin embryos in this region can recover their normal rate of calcium uptake if the interference due to lowering of the ambient temperature does not last more than two days. The embryos of these sea urchins can withstand an acute x-ray dose of up to 1,200 roentgens without showing significant difference in calcium uptake from that of the control. An acute dose of about 19,000 roentgens reduces the uptake of calcium to one half of the control value. (auth)

33605 FACTORS CONTROLLING THE DISTRIBUTION OF THE RARE EARTHS IN THE ENVIRONMENT AND IN LIVING ORGANISMS. Ralph F. Palumbo (Univ. of Washington, Seattle). p.533-7 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Many radioactive lanthanides are made available in the production of nuclear energy; however, studies of their distribution in the environment and their uptake by living organisms have been confined primarily to Ce^{144}–Pr^{144}, lanthanum-140, promethium-147, and yttrium-90 and 91. Ecological factors governing the distribution of the rare earths are physico-chemical and biological. The first are concerned with the properties of the nuclide and the nature of the environment, and the second with the selectivity and retention of the nuclide by the organism. Because the rare earth nuclides usually exist in the particulate state, they are not readily available to and are poorly absorbed by terrestrial or aquatic organisms. They are accumulated principally by surface adsorption, and the degree of accumulation can be related to surface area and to species differences. Laboratory studies indicate that animals, including man, are unable to absorb the rare earths to any extent from the gastrointestinal tract and that elimination of them is rapid. The principal sites of deposition are the bone and the liver. (auth)

33606 CESIUM AND ITS RELATIONSHIPS TO POTASSIUM IN ECOLOGY. J. J. Davis (General Electric Co., Richland, Wash.). p.539-56 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963. (HW-SA-2447)

The relationship of stable and radioactive cesium in ecology is discussed. The physical and chemical similarities between cesium and potassium and their analogous actions in physiological processes are reviewed. It is pointed out that it has become common practice to report Cs^{137} concentrations in biological samples as Cs^{137}/K ratios. The occurrence of Cs in the biosphere, its role in physiological processes, and its cycling and significance in ecological systems are discussed. The contamination of the natural environment by Cs^{137} from nuclear detonations and nuclear reactor wastes is described. Results are summarized from tracer studies on the absorption of Cs by soils, metabolism by plants and animals, and cycling in ecological systems. Hazards to man from Cs^{137} in his environment are discussed. (C.H.)

33607 REVIEW AND DISCUSSION OF BARIUM. Norman R. French (Univ. of California, Los Angeles). p.557-60 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Isotopes of barium account for a sizable fraction of the activity in fresh fission products. They are readily assimilated by aquatic vertebrates and by invertebrates. They are concentrated by some insects, and perhaps by certain soil invertebrates. Mammals accumulate radiobarium in all tissues, and it is fixed in the bones. Radioactive barium may provide considerable radiation doses on a short-term basis to certain facets of the ecosystem. It is concluded that these isotopes merit increased attention by the radioecologist. (auth)

33608 IRON AND COBALT IN ECOLOGY. F. G. Lowman (Univ. of Washington, Seattle). p.561-7 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The roles of iron and cobalt in ecology are dependent upon their physical and chemical characteristics in the environment and upon the biological demand for these elements. Iron and, to a lesser degree, cobalt are important elements in the physiology of plants and animals. The introduction of radioisotopes of iron and cobalt may be used to determine the roles of these elements in the metabolic patterns and mass transfers within a given ecosystem. Most investigations of this type have been done in marine environments near nuclear weapons test sites. Plankton, collected from an area of sea water which had been contaminated with radioactivity for a period of six weeks, exhibited average concentration factors for radioactive iron and cobalt of 90,000 and 100,000, respectively, and contained the stable counterparts of these elements in about the same ratio as they were present in the water. The roles of iron and cobalt in two food chains were investigated in the marine environment in the Central Pacific. In the first food chain, discrimination against cobalt-57, 58, 60, was progressive throughout the trophic levels. Iron-55, 59 was actively concentrated in the om-

nivorous fish, and it accounted for a reduced percentage of the total radioactivity in the carnivorous fish due to the presence of large amounts of zinc-65. In the second food chain the birds, which feed primarily upon omnivorous fish and secondarily upon squid, did not retain significant amounts of the radioisotopes of cobalt or iron but retained a major part of the ingested zinc-65. (auth)

33609 ENVIRONMENTAL BEHAVIOR OF CHROMIUM AND NEPTUNIUM. Richard F. Foster (General Electric Co., Richland, Wash.). p.569-76 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The most abundant source of chromium is chromite ore with the largest known domestic reserves situated in Montana. Chromium has been detected in living organisms in only trace quantities and seemingly plays no essential role in the physiology of plants or animals. The principal means through which chromium enters the biosphere is the liquid and gaseous effluents of industrial plants which use this element. Chromium is a toxic material and if present in high concentration can damage plants, animals, and humans. Aquatic organisms appear to be especially vulnerable. The hexavalent state is more readily assimilated than the trivalent state and is generally considered to be at least a hundred times more toxic than the trivalent state. The red blood cells have a strong affinity for hexavalent chromium which has led to the popular use of chromium-51 in clinical studies of hematologic disorders. Ultimately, chromium is concentrated in the reticuloendothelial system, and in humans it is eliminated principally in the urine. Chromium-51 is the only radioisotope which has environmental importance at the present time, and this isotope is present in the effluent from the Hanford reactors which enters the Columbia River. Retention by Columbia River solids is measurable but not of great significance. Chromium-51 accumulates in algae of the river, but its concentration diminishes rapidly in higher trophic levels. The exposed parts of crops which have been in direct contact with irrigation water which contains chromium-51 may have detectable quantities of this isotope, but root crops and fruits contain insignificant amounts. It has not been found in milk or other products of animals grazed on irrigated pasture. Chromium-51 has little radiological significance since its decay to stable vanadium releases very little ionizing radiation. The artificial element neptunium has two radioisotopes of some interest to ecologists. Neptunium-239 is created by the capture of a slow neutron by uranium-238 and decays with a half-life of 2.3 days to become fissionable plutonium-239. Substantial quantities of neptunium-239 are created in plutonium-producing reactors and in conventional atomic bombs, and thus it has been measured in the environment. The alpha-emitting isotope, neptunium-237, has not entered the biosphere in appreciable quantity. It has a very long half-life (2.2×10^6 years) and thus a very low specific activity. The element, which resembles the rare earths in several aspects, is not easily incorporated into ecosystems, and it has not been reported in terrestrial biota or beyond the second trophic level in aquatic forms. The radiological importance of neptunium has primarily been associated with the presence of neptunium-239 in drinking water and the potential dose imparted to the gastrointestinal tract. (auth)

33610 SOME ASPECTS OF THE BIOLOGY OF ZIRCONIUM-95. Edward E. Held (Univ. of Washington, Seattle). p.577-9 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Zirconium has no biological function although it has been found in trace amounts in plants. Zirconium-95 is of biological interest because of its relatively high yield in nuclear fission and the fact that the biological half-life is much longer than the 65-day physical half-life. The metabolism of Zr^{65} by plants and animals is reviewed. It is suggested that Zr^{65} would be useful as a tracer in biological studies in aquatic systems. (C.H.)

33611 IODINE IN THE ENVIRONMENT. W. C. Hanson (General Electric Co., Richland, Wash.). p.581-601 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963. (HW-SA-2271(Rev.))

Selected literature pertinent to the occurrence, utilization, and effects of iodine and iodine isotopes in the environment is reviewed. (C.H.)

33612 TRITIUM IN ECOLOGY—A REVIEW. Donald M. Skauen (Univ. of Connecticut, Noank). p.603-9 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

A search of the literature was conducted to compile a bibliography of tritium of interest to ecologists. With the exception of these references dealing with geology, very few articles were found which describe research in other areas of ecology. Brief comments are included on references which appeared unusual or particularly noteworthy and a bibliography of 155 titles is included. (auth)

33613 THE NATURAL RADIOACTIVE SERIES IN ORGANIC MATERIAL. F. F. Koczy (Univ. of Miami, Fla.). p.611-13 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

The geochemical behavior of thorium, uranium, and radium in the hydrosphere and the influence of the biosphere on the geochemistry of these elements are reviewed. It is pointed out that existing data are not complete enough to draw definite conclusions. (C.H.)

33614 ARSENIC AND ITS RADIOISOTOPES IN THE ENVIRONS. R. L. Junkins (General Electric Co., Richland, Wash.). p.615-18 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963. (HW-SA-2259)

Exposure to toxic quantities of arsenic remains a risk both in and out of industry. Much has been learned about the metabolism and biochemistry of the arsenical compounds. Data available on arsenic content in natural materials are still rather sparse. Because arsenic is in the same group of elements as phosphorus, concentration of arsenic by plants and animals would be expected and this is verified in some cases but contraindicated in others. The primary ecological significance of radioisotopes of arsenic is the use of tracers and analytical techniques by neutron activation of normal arsenic which offers convenient ways to improve the knowledge of the distribution and behavior of arsenic in ecosystems. (auth)

33615 REVIEW OF ZINC IN ECOLOGY. T. R. Rice (U. S. Bureau of Commercial Fisheries, Beaufort, N. C.). p.619-31 of "Radioecology." New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963.

Zinc has been shown to be an almost universal constituent of living matter and is considered essential for the growth and normal development of most microorganisms, plants, and animals. It is now necessary that the role of

zinc in the terrestrial, fresh-water, and marine environments be delineated since zinc-65 has been shown to be present in all three. Zinc-65 occurs in these environments as an induced radionuclide, produced at the time of nuclear detonations or in water used as a coolant for nuclear reactors. It has a half-life of 245 days and has been used widely for biological studies. Difficulties encountered in the analytical determination of zinc at levels existing in plants and animals and equal difficulties of freeing water and reagents from contamination with zinc are reviewed. (C.H.)

Radiation Effects on Living Tissues

Refer also to abstract 35208.

33616 (NYO-10350) ISOCENTRIC DOSAGE SYSTEM FOR STATIONARY AND MOVING GAMMA BEAMS. Carl B. Baestrup and Richard T. Mooney (Columbia. Univ., New York and Francis Delafield Hospital, New York). [1962]. Contract AT(30-1)-2649]. 8p. (CONF-137-1)

From the Eastern Conference of Radiology, New York, March 1962.

Isodose charts are described for use in determining isocentric radiation dose for stationary and moving supervoltage γ beams. (C.H.)

33617 (ORNL-TM-640) DOSIMETRY OF HIGH-ENERGY RADIATIONS. Progress Report, July 1, 1962 to June 30, 1963. J. E. Turner, Jacob Neufeld, and W. S. Snyder (Oak Ridge National Lab., Tenn.). Aug. 14, 1963. Contract W-7405-eng-26. 13p.

Calculations of rad and rem doses in a tissue slab irradiated by protons with energies up to 400 Mev were completed. A code was also developed for calculating dose in a finite geometry phantom (parallelepiped), and results for this case are nearing completion. Preliminary studies at proton energies greater than 400 Mev are in progress. To analyze the biological response of animals exposed to neutron irradiation, a code was written to compute the distribution of dose with LET. Although no machine results are available, several first-collision calculations were made, in order to test the usefulness of this type of analysis. (auth)

33618 (TID-17557) ANNUAL REPORT [ON] RADIATION OF FISH, OCTOBER 1961 THROUGH SEPTEMBER 1962. PART I. APPLICATION OF RADIATION-PASTEURIZATION PROCESSES TO PACIFIC CRAB AND FLOUNDER. David Miyauchi and Melvin Eklund. PART II. EFFECTS OF IONIZING RADIATION ON LIPIDS OF FISH. Virginia F. Stout (Fish and Wildlife Service. Technological Lab., Seattle). Oct. 11, 1962. Contract AT(49-11)-2058. 43p.

Radiation processing increased the refrigerated storage life of crab meat and sole fillets from 2 to 6 times that of untreated samples. The use of antioxidants or a nitrogen pack to minimize the development of off flavor was investigated. Procedures were developed for determining total bacteria, yeasts, and molds on crab meat. Data are included from a study of the effects of γ radiation on fish lipids. (C.H.)

33619 (TID-19153) CYTOLOGICAL AND ULTRAVIOLET RADIATION STUDIES ON THE CILIATE SPATHIDIUM SPATHULA. Progress Report. Donald B. Williams (Vassar Coll., Poughkeepsie, N. Y.). July 30, 1963. Contract AT(30-1)-3102. 7p.

The nature of sensitivity of the predaceous ciliate Spathidium spathula to ultraviolet and x radiation was investigated. Results from a series of experiments led to the conclusion that the manner of response of Spathidium to both x and ultraviolet radiation is similar but the x ray damage occurs at much lower doses compared to other ciliates, whereas ultraviolet damage occurs at much the same doses compared to other ciliates. (C.H.)

33620 (UR-627) ELEMENTARY EXPERIMENTS IN RADIATION BIOLOGY. Alison P. Casarett and Thomas P. Davis (Rochester, N. Y. Univ. Atomic Energy Project). July 3, 1963. Contract W-7401-eng-49. 65p.

Fourteen laboratory exercises, suitable for high school and elementary college level, are presented which illustrate the use of GM counters, some fundamental properties of various radiations, the use of radioactive isotopes as tracers in studying biological processes, and certain effects of radiation on biological systems. Autoradiographic information, a list of some of the available motion picture films dealing with radiation and its effects, and suggested references are also included. (auth)

33621 (JPRS-20379) COMBINED ACTION OF NEUTRON IRRADIATION AND ELEVATED TEMPERATURE ON ANIMALS. A. F. Gur'yev. Translated from Gigiena i Sanit., 28: No. 5, 24-9(May 1963). 7p. (OTS-63-31396)

The effects of elevated ambient-air temperature on the induction and development of radiation injuries caused by fractionated fast neutron exposure were studied in rabbits. Animals exposed to a maximum tissue dose of 0.4 rad/week exhibited changes in the red and white blood cell indices and blood coagulation system. These changes were accelerated in animals subjected to the combined action of fast neutron irradiation and elevated ambient air temperature. (C.H.)

33622 (JPRS-20425) USE OF RADIOISOTOPES AND RADIATION IN THE CONTROL OF INSECT PESTS OF PLANTS AND ANIMALS. S. V. Andreev (Andreyev), B. K. Martens, V. A. Molchanova, and Z. I. Samoylova. Translation of a Russian-language Manuscript. [nd]. 11p. (OTS-63-31422)

Research in the Soviet Union on the use of radioisotopes and radiation in the control of insect pests is reviewed. Research is also reported on the use of powerful sources of ionizing radiation to actively combat insect pests. (30 references) (C.H.)

33623 SPLEEN FACTOR EFFECT ON CELLULAR RECOVERY OF IRRADIATED BONE MARROW. Thomas A. Strike and Friedrich Ellinger (Naval Medical Research Inst., Bethesda, Md.). Acta Haematol., 29: 96–101(1963). (In English)

It was previously demonstrated, by means of fixed tissue sections, that cell-free spleen extracts are capable of accelerating the general radiation recovery of spleen and bone marrow. For quantitation of various bone marrow cell types, further work using smear preparations rather than sections was conducted. The results showed accelerated recovery of bone marrow cells in guinea pigs treated with heterologous (canine) spleen extract following exposure to a single, whole-body dose of 650 r Co^{60} γ radiation ($LD_{70/20}$). A purified fraction of dog spleen extract which reduced radiation mortality, exhibited a similar trend. Erythrocytes, reticulocytes, granulocytes, megakaryocytes, and mitotic activity all appeared to be influenced in the same manner. The 7th postirradiation day results showed that spleen extract treatment does not protect bone marrow cells against the initial impact of irradiation. This indicates that the reduction in radiation mortality following spleen extract treatment is related to

a recovery rather than a protective mechanism. Accelerated recovery in the spleen-treated animals is most evident on the 14th postirradiation day. Erythrocytic regeneration begins at this time in the spleen-extract-treated animals, as evidenced by increased marrow reticulocytes. This finding substantiates the previous observation of intense erythropoietic activity in the splenic red pulp of extract-treated animals at this time. These observations support the contention of an induction of stem cell activity, and possibly of accelerated maturation of various cellular elements of the bone marrow, as a mechanism by which spleen extracts decrease radiation mortality. (BBB)

33624 RADIOSENSITIVITY OF MARROW CELLS RESPONSIBLE FOR RE-ESTABLISHING ERYTHROPOIESIS IN LETHALLY IRRADIATED MICE. G. S. Hodgson (Oak Ridge National Lab., Tenn.). Acta Physiol. Latinoam., 12: 365-9(1962). (In English)

The relation between erythrocyte Fe^{59} uptake and marrow dose in lethally irradiated mice was used to study the radiosensitivity of cells responsible for repopulation of erythropoietic tissue. Bone marrow was irradiated in vivo and in vitro. Results obtained give a D_{37} 71 r for both irradiation conditions. Irradiating marrow under anoxic conditions has a marked protective effect. (auth)

33625 THE INFLUENCE OF IONIZING RADIATION ON THE KINETICS OF ENZYME REACTIONS. Liselotte Schachinger (Institut für Strahlenschutzforschung, Nuremburg). Aerztl. Forsch., 16: 262-3(May 10, 1962). (In German)

Studies were conducted on the effects of radiation on diphosphopyridine nucleotide (DPN)-coupled enzyme reactions in vitro, including those catalyzed by alcohol dehydrogenase (ADH), glutamic dehydrogenase (GDH), lactic dehydrogenase (LDH), and malic dehydrogenase (MDH). In contrast to results of earlier studies, radiation was found to affect the kinetics of these enzyme reactions. It was shown that the reaction catalyzed by ADH is inhibited during irradiation with 15,000 r/min, that this inhibition is much greater than inactivation of ADH by prior irradiation of the enzyme, and that the ADH-catalyzed reverse reaction is accelerated by irradiation. Similar results were found with LDH and MDH. Since irradiation of the enzyme alone causes little inactivation, DPN and DPNH were irradiated to determine the cause for the greater sensitivity of the entire system. It was shown that the coenzyme is irreversibly altered by irradiation, ~30% inactivation by 47,000 r. This inactivation was more evident in the presence of ADH than MDH, LDH, and GDH. Irradiation of DPNH caused, in addition to irreversible degradation, conversion to DPN. This reversible oxidation to DPN could be depressed by the presence of glycine, cysteine, and small amounts of ethanol, whereas it was stimulated by α-ketoglutarate and acetaldehyde. Hence, it appeared to occur via a radiation-induced chemical reaction. (H.H.D.)

33626 THE EARLY RADIATION RESPONSE OF ANNELID NERVE AND MUSCLE. Hans-Jochen Schliep (Institut fur Strahlenschutzforschung, Nuremberg). Aerztl. Forsch., 16: 263-5(May 10, 1962). (In German)

Annelid nerve-muscle and muscle preparations, in resemblance to rabbit intestine, show an immediate, reversible response to low doses of radiation. The tonus and motility of such preparations of earthworms and leeches were depressed by doses greater than 25 r of 50-kv x rays applied at a rate of 115 r/min. Nerve-muscle preparations were more sensitive than muscle alone. These changes in spontaneous motility were reversible when the preparations were irradiated in buffer at pH 7.2 to 8.0, but irreversible in buffer at pH 6.8 to 7.1. In the first case the contraction induced by irradiation lasted for a few min, compared to several hr in the latter case. The contraction also persisted in the presence of dinitrophenol or Ca-free buffer. The induced contraction was dose-rate dependent; for example, in a leech muscle preparation, stepwise increases in contractions were elicited by 10- to 50-sec irradiation at 50 kr/min. The finding that the reversibility of these changes is lacking when irradiation is carried out in acid or K-free buffer suggests that this phenomenon may involve changes in permeability of nerve and muscle cell membranes. (BBB)

33627 ELECTROENCEPHALOGRAPHIC FINDINGS IN MAMMALS AFTER ROENTGEN IRRADIATION. Hanns Gangloff (Universitat, Munich). Aerztl. Forsch., 16: 266-7 (May 10, 1962). (In German)

Previous studies indicated that, with the exception of the cerebral cortex, the central nervous system shows little change in electrical activity after exposure to ionizing radiation at doses below 2000 r. However, it was possible to show that in cats with stereotactically implanted electrodes, relatively small doses of x rays (200 and 400 r at 40 and 110 r/min) elicit changes in subcortical bioelectric activity. These doses produced only slight general symptoms of radiation sickness and no neurologic symptoms. Changes in the electroencephalogram are manifested by spike discharges appearing within an hour of exposure and disappearing after several days. Such changes could be elicited in well-defined regions such as the horn of Ammon in the hippocampus after wholebody or head irradiation. The spike discharges reached max intensity within 3 to 7 hr postexposure, and the hippocampus activity could be detected for as long as 10 to 14 days afterward. It was more intense when the animals were asleep and was attenuated by their awakening. Similar results were obtained in rabbits. (BBB)

33628 RADIOBIOLOGY OF THE SPINAL CORD, WITH SPECIAL CONSIDERATION OF THE LATE REACTIONS. Alfred Breit (Stadtische Krankenhaus, Passau, Ger.). Aerztl. Forsch., 16: 269-70(May 10, 1962). (In German)

In rabbits and dogs subjected to relatively low X-ray doses, changes in the spinal cord could be detected, contrary to earlier findings, if observations were carried out long enough. For example, localized irradiation of the spinal cord of rabbits with doses within the range used clinically (total doses of 3500 to 7000 r given in daily doses of 200 r) caused changes visible in macroscopic sections of the cord examined three to five months later. These changes, most striking in the anterior-lateral columns, increased progressively and in a consistent pattern during the postirradiation observation period. The changes were strongly dependent on the dose rate; for example, in dogs, paralysis was more frequent following two exposures to 500 r/hr than after 5 exposures to 200 r/hr (to total doses of 2000 r). After a total dose of 9000 r given at a rate of 500 r/hr, 100% of dogs showed paralysis 10 months later, whereas at $\frac{1}{3}$ this dose only 45% were paralyzed 36 months postirradiation. As seen from these late reactions, it is concluded that the tolerance of the central nervous system to radiation is much lower than previously believed. (H.H.D.)

33629 EARLY CHANGES DETECTABLE BY ELECTRON MICROSCOPY IN THE BONE MARROW OF RATS AFTER WHOLE-BODY IRRADIATION. Hans Bauer (Universitat, Heidelberg). Aerztl. Forsch., 16: 377-82 (July 10, 1962). (In German)

Intracellular structures in bone marrow cells were examined 30 to 60 min after exposure of rats to 500-r doses of Co^{60} γ radiation. Thirty min after irradiation, injury to these structures wes clearly apparent. In eosinophil myelocytes, for example, mitochondrial swelling was evident and the cristae disoriented. Small cytoplasmic vacuoles were present and the Golgi zone was vesiculated. Otherwise, no structural changes were visible at this time. In plasma cells, vacuoles were present in the periphery of the Golgi zone, but the mitochondria and the well-developed endoplasmic reticulum appeared normal. However, marked structural changes occurred in reticulum cells at 30 min: mitochondria were markedly swollen and vacuolated with fragmented cristae. Although the membrane system was intact, the cytoplasm had a honeycomb appearance, and the nucleoli appeared granulated. At 1 hr after exposure the damage was more severe, especially in cells of the myeloid series. Granules in basophilic promyelocytes were markedly degenerated and vacuolated. At this time defects in the plasma membrane were also present and vacuoles appeared under the nuclear membrane. From the observed morphologic injury to the mitochondria, it was concluded that their biochemical function in providing the cell energy metabolites would be impaired following irradiation. No decrease in the number of mitochondria per cell was noted in the 1-hr period. (BBB)

33630 BIOMETRICAL STUDY OF RADIATION-INDUCED GENETIC VARIABILITY IN A PURE DIPLOID SELFING LINE. M. Dalebroux (Università, Pavia, Italy). Ann. Amelioration Plantes, 12: 93-115(1962). (EUR-143.f) (In French)

After irradiation of seeds of a pure diploid selfing line, the variances and covariances in the successive generations were partitioned into additive, dominance and environmental components. Two different hypotheses are studied: that the plants grown directly from irradiated seeds are not chimeras, and that the plants grown directly from irradiated seeds are chimeras. In both cases, the author tries a theoretical approach in order to answer the following question: Can the radiation-induced mutations in a multifactorial genotype be dominant as often as recessive? (auth)

33631 EFFECTS OF X-IRRADIATION ON PROTEOLYTIC ENZYMES OF MOUSE SPLEEN. Atsuhiko Takeda and Yoshihiro Harada. Ann. Rept. Radiation Center Osaka Prefect., 3: 128-9(1962). (In English)

Changes in proteolytic activity concerned with an increase in protein-free DNA in the x-irradiated mouse spleen were investigated. After 1000 r x irradiation, the proteolytic activity of spleen increased linearly up to 1.9 times the controls during 4 hr, and the rate of protein-free DNA also increased over 2 times during 6 hr. The relation between the changes is discussed. It was concluded that the change in protein-free DNA comes as a result of splitting from the DNA protein complex (insoluble in 0.14M NaCl) of which the protein moiety has been digested by the intracellular proteolytic enzymes being progressively activated by irradiation. (P.C.H.)

33632 EFFECT OF X-IRRADIATION ON PLASMA LACTIC DEHYDROGENASE ACTIVITY IN RABBIT AND MOUSE. Yasuharu Hori and Kazuo Nishio. Ann. Rept. Radiation Center Osaka Prefect., 3: 130-2(1962). (In English)

The plasma LDH activity in rabbits and NA-2 strain mice was studied after whole-body x irradiation at 300, 150, and 74 r in order to determine the threshold of such doses on plasma LDH. Plasma LDH levels of rabbits irradiated with 300 r were markedly increased in 8 hr, 2, 7, and 10 days after irradiation. The degree of elevation was highest at 1 week after irradiation and was 2 to 3.5 times normal. The threshold for plasma LDH levels in rabbits was 75 r. Plasma LDH levels of mice irradiated with 300 r increased to the highest level of about 2.5 times normal in 4 hr and showed another small elevation peak in 7 days, then appeared to be back to normal. 150 r irradiation elevated the enzyme level in 12 hr and that of 75 r expressed any elevation higher than normal level. (P.C.H.)

33633 EFFECT OF Cs^{137} AND Sr^{90} ON GROWTH AND REPRODUCTION OF MICE. PART I. Kazuo Nishio and Sakiko Sugiura. Ann. Rept. Radiation Center Osaka Prefect., 3: 133-6(1962). (In English)

Mice were continuously fed water contaminated with Cs^{137} and Sr^{90}, and growth and reproduction were observed. The intensity of contamination was 0.4 mC of Cs^{137} and 0.1 mC of Sr^{90} per ml in one group and $1/10$ and $1/100$ of these values in two other groups. The administration of isotopes began from mating and 1st and 2nd generations were examined. Growth curves of the 1st generation did not differ among four groups, but differed significantly in two groups in the 2nd generation. The mortality rate for the mice was the same for all groups in both the 1st and 2nd generations in the period from birth to 14 weeks. Sterility was observed in some of the female mice. (P.C.H.)

33634 THE SYNTHESIS OF RIBONUCLEIC ACIDS IN IRRADIATED EHRLICH ASCITES TUMOR CELLS. Yasuhiko Takamori. Ann. Rept. Radiation Center Osaka Prefect., 3: 141-2(1962). (In English)

The effects of radiation on the incorporation of P^{32} into various RNAs of Ehrlich ascites tumor cells (EAT-cells) was investigated. The incorporation of P^{32} into RNA was not significantly affected by 800 and 1000 r irradiation, whereas the specific activity of DNA was reduced to 75 to 80% of the unirradiated control. The results evidently show the minor effect of radiation on the synthesis of total RNA. It was concluded that the synthesis of nucleolar RNA is more radiosensitive than other RNA fractions, especially nucleolar-RNA II. (P.C.H.)

33635 THE EFFECTS OF IONIZING RADIATION ON TRYPSIN. I. LOSSES OF ESTERASE AND PROTEASE ACTIVITIES OF TRYPSIN AND TRYPSIN-INHIBITOR COMPOUND. Joseph D. Shore, Bert M. Tolbert, and Howerde E. Sauberlich (Fitzsimons General Hospital, Denver). Arch. Biochem. Biophys., 102: 125-31(July 1963).

Crystalline trypsin and trypsin-inhibitor (T-I) compound were irradiated as dry solids in vacuo with cesium-137 γ rays up to 50 megarads. Results followed first-order inactivation curves, consistent with a target theory. For trypsin esterase and protease activities, D_{37} values were 33 and 26.8 megarads, respectively, and for T-I compound 22 and 14 megarads, respectively. Postirradiation exposure to oxygen enhanced the loss of both activities, with the esterase activity lost at a greater rate and becoming equal to the rate of loss of protease activity. These results were discussed in terms of possible structural changes in the trypsin caused by radiation. (auth)

33636 SEDIMENTATION STUDIES ON DNA FROM IRRADIATED E. COLI. Prasanta K. Ganguli and Sukhendu B. Bhattacharjee (Saha Inst. of Nuclear Physics, Calcutta). Arch. Biochem. Biophys., 102: 132-6(July 1963).

DNA prepared from E. coli cells irradiated by x rays up

to a dose of 60 kilorads showed neither a change in the sedimentation coefficient at infinite dilution nor a change in the dependence of sedimentation coefficient on concentration. Heat-treated DNA showed a large decrease in the concentration dependence of the sedimentation coefficient. It has been concluded that there is no change in the molecular weight and configuration of DNA collected from irradiated E. coli. (auth)

33637 EFFECT OF AET ON γ-RAY CATARACTS. Calvin Hanna and James E. O'Brien (Univ. of Arkansas, Little Rock). Arch. Intern. Pharmacodyn., 142: 198-205 (Mar. 1, 1963). (In English)

Although 2-aminoethylisothiouronium bromide hydrobromide (AET) is one of the most potent radioprotective agents, it failed in previous studies to protect the lens against ionizing radiation as manifested by the development of radiation cataracts in surviving mice. Revaluation of this problem was undertaken using the rat. Cell production was also studied by intraocular injections of H^3-labeled thymidine which is incorporated into cellular DNA during the premitotic doubling stage of cell division. Thus, at various intervals following irradiation, it was possible to determine the effects of radiation on the proliferation rate of the lens epithelium and the influence of pretreatment with AET. Rats were given a 200 mg/kg intraperitoneal injection of AET 15 min prior to irradiation and placed in molds behind a 12-in. lead shield so that only one eye was irradiated. A second injection of 100 mg/kg of AET was given immediately before irradiation. The animals were given a Co^{60} r dose at the rate of 40 r/min to 2400 r. AET pretreatment of irradiated eyes was shown to give marked protection against early radioinduced changes in the lens, the structure of the fibers, and the eye lid. AET radioprotective action was still evident at eight months. Clinically and histologically the AET-irradiated lenses showed few signs of radiation damage during the first 14 days following radiation. Cell death and changes in the palisade structure of cells appeared minimal in the AET-irradiated lenses compared to marked changes seen in the irradiated-only lenses at 4 months. Slight signs of lens epithelial cell death were seen in the AET-irradiated animals sacrificed at 4-8 months, whereas in the irradiated-only animals the structure of the lens was almost unrecognizable at this time. AET pretreatment alone had no noticeable effect on the structure of the lens. Clinical cataract was absent or minor in the AET-irradiated eye in 8 months while in the irradiated-only eye in the same animal the cataract was complete. In the AET-irradiated eyes there was an absence of epilation of the lids after 8 months. (TCO)

33638 RADIATION-CAUSED CYTOCHEMICAL CHANGES IN NEURONS. Eugene H. Kagan, Robert H. Brownson, and Daniel B. Suter (Medical Coll. of Virginia, Richmond). Arch. Pathol., 74: 195-203(Sept. 1962).

The acute effects of ionizing radiation on the brain of rats were evaluated by using the acid phosphatase method of Gomori. Head irradiation was carried out with 1000-kv x rays at dose rates of 250 to 600 r/min and doses of 1500 to 10,000 r. The brains were examined 3 hr to 4 months later. The observed acute behavioral changes of apathy and sluggishness correlated with alterations in acid-phosphatase-containing particles, which showed increased size and conglomeration in cortical neurons and especially Purkinje cells of the cerebellum. This early cytochemical effect of radiation was not noted with cresyl fast violet or periodic acid-Schiff-stained material. The alterations were limited to ganglion cells; no glial or vascular lesions were noted by any staining procedure. In the Purkinje cells at higher dose ranges, up to one-half of the cells showed alterations in the form of swelling and conglomeration of the acid phosphatase particles, as well as diffuse cytoplasmic staining. These alterations in acid-phosphatase-containing particles were similar to changes in rat brains subjected to anoxic and anoxic-ischemic conditions, autolysis, and injection of diphtheria toxin. There was also a striking similarity between these changes and alterations in kidney and liver lysosomes as a result of experimental hydronephrosis. Animals killed four months after irradiation demonstrated the reversible nature of the lesion, which is correlated with reports of an initial reversible behavioral syndrome. The described cytochemical lesion is interpreted as morphological evidence of cell damage or altered cellular metabolism and not as a specific lesion caused by x irradiation. The apparent reversibility of the lesion and the fact that several different mechanisms have all demonstrated similar effects on acid-phosphatase-containing particles in brain, kidney, and liver further point toward its nonspecific nature. (H.H.D.)

33639 THE ACTION OF X RAYS AND CYTOSTATIC COMPOUNDS ON DPN CONTENT AND DNA SYNTHESIS IN ASCITES TUMOR CELLS. H. Hilz, B. Hubmann, M. Oldekop, M. Scholz, and M. v. Gossler (Universität, Hamburg). Biochem. Z., 336: 62-76(1962). (In German)

Changes in DPN (diphosphopyridine nucleotide) content and incorporation of thymidine-H^3 by DNA were studied in tumor cells irradiated in vitro with 3000 r. DPN content decreased 63% and DNA synthesis 58% 20 min after irradiation in the absence of nicotinamide. When nicotinamide was added to the cultures in a final concentration of 4×10^{-3} M, the respective decreases were only 10 and 16%. Thus irradiated tumor cells exhibit parallel changes in DPN contents and DNA synthesis, and both these processes can be restored in part by nicotinamide. The extent of the irradiation damage in regard to both these parameters is greatly influenced by the conditions during the incubation. Ethylenimines, H_2O_2, and organic peroxides cause similar changes and appear to be true radiomimetics in the system studied. The primary damage to DPN content and DNA synthesis is a potentially reversible process. Only under higher irradiation doses or higher concentrations of cytostatics is secondary and irreparable injury superimposed. The main feature of the latter is inhibition of DPN synthesis. These results show the dependence of DNA synthesis on the DPN content of the cells. They also provide evidence for dependence of the initial and rapid decrease in DPN on a release of nicotinamide by the cells into the incubation medium. The possibility of activation of DPNase being involved in this loss is discussed. (H.H.D.)

33640 CHANGES IN THE CONTENT OF SULFHYDRYL GROUPS OF NUCLEAR PROTEINS IN THE LIVER CELLS OF IRRADIATED RATS. E. M. Kedrova, Zh. A. Antokol'skaya, and V. M. Rodionov (Inst. of Biological and Medical Chemistry, Academy of Medical Sciences, Moscow). Biochemistry (USSR) (English Transl.), 27: 579-81(Jan.-Feb. 1963).

The content of SH-groups has been studied in three fractions of soluble proteins isolated from the nuclei of the liver cells of rats before, and 30 min. and 24, 48, and 72 hr after irradiation with doses of 1500 r. Thirty minutes after irradiation the content of SH-groups in the globulins fell on the average by 30%, and in the diphosphopyridine nucleotide (DPN) by 44%. It has been suggested that inactivation of the SH-groups of the nuclear proteins may play an essential role in the mechanism of the antimitotic action of ionizing radiation. (auth)

33641 THE IMPORTANCE OF THE HYPOPHYSIS IN THE REACTION OF ACCELERATION OF CHOLESTEROL SYNTHESIS IN RESPONSE TO IRRADIATION. K. A. Tret'yakova (All-Union Research Inst. of Experimental Endocrinology, Moscow). Biochemistry (USSR) (English Transl.), 27: 679-81(Mar.-Apr. 1963).

An investigation was made of the change in rate of cholesterol synthesis that occurs in hypophysectomized rats during irradiation. Male albino rats were used for the experiment. It was found that hypophysectomy and chemical hypophyseal block with desoxycorticosterone (DOCA) retard cholesterol synthesis in the liver. Irradiation of rats following blocking of the hypophysis is accompanied by a smaller increase in the velocity of cholesterol synthesis than was observed during irradiation of intact animals. Irradiation of hypophysectomized rats causes no statistically significant acceleration of cholesterol synthesis in the early periods after hypophysectomy. (H.M.G.)

33642 THE INFLUENCE OF WHOLE-BODY X IRRADIATION ON PLASMA CELLS OF GUINEA PIG INTESTINE. P. M. Ansari, H. Eder, and W. Naegle (Battelle Memorial Inst., Frankfurt am Main). Blut, 8: 397-403(Oct. 1962). (In German)

Cytologic and cytochemical studies were made of the intestinal wall at various intervals after 250-kv x irradiation of guinea pigs with 300, 600, or 1200 r. Changes in DNA and RNA contents of cells were evaluated from sections stained with the methyl green-pyronin technique. As early as 1 hr after irradiation at the lowest dose, RNA content of the cytoplasm of plasma cells in the crypts of Kieberkühn was diminished, on the basis of its weaker staining with pyronin than in control sections. Many cells already showed large clear zones in cytoplasm as well as pyknosis and lysis of nuclei. However, DNA content, on the basis of nuclear staining with methyl green, was unaffected at this time. After 600 r the plasma cells showed marked loss of staining and widespread destruction; the effects after 1200 r were similar. Nuclear fragmentation was pronounced 2 to 4 days after 600 r. Some plasma cells were recognizable 10 days postirradiation but their staining reactions were still weak. Numerous intermediary forms transitional between mesenchymal cells and plasma cells were evident at this time. This suggests that the plasma cell population is replenished by proliferation and differentiation of mesenchymal cells. Although lymphatic tissue is plentiful in intestine it did not appear to give rise to plasma cells, at least at earlier periods after irradiation. Pyronin-positive mesenchymal cells in intestine appeared to survive irradiation, which is in contrast to the radiosensitivity of lymphatic cells. (H.H.D.)

33643 STUDIES IN THE DESIGN AND APPLICATIONS OF A CLINICAL LOW BACKGROUND COUNTING ROOM. N. G. Trott, C. J. Parnell, H. J. Hodt, and R. F. Entwistle (Royal Cancer Hospital and Royal Marsden Hospital, London). Brit. J. Radiol., 36: 592-607(Aug. 1963).

Design features are described for an inexpensive, demountable shielded room for clinical measurements in low-level tracer studies and determinations of body burdens of radioactivity. Chalk containing up to 99% calcium carbonate, in 50 lb polyethylene and paper bags was used for shielding. The construction, comparative studies of the shielding provided, and illustrative measurements on human subjects are described. (C.H.)

33644 THE CONVERSION OF A SMALL LABORATORY INTO A LOW BACKGROUND ROOM SUITABLE FOR COUNTING WHOLE BODY RADIATION. J. W. Tappin (Middlesex Hospital Medical School, London). Brit. J. Radiol., 36: 608-10(Aug. 1963).

A small basement laboratory was converted into a low background room for whole-body counting. Wall and ceiling shielding was provided by 2 ft of compressed chalk in the form of interlocking bricks having a density of approximately 2 g/cc. A 5-in.-thick steel sliding door permitted access. The inside of the room was lined with 0.25 in. of aged Pb backed by 0.25 in. of steel. The floor was constructed of 0.25-in. steel plate built up to a thickness of 5 in. laid on a 2-ft bed of low-activity concrete. Results are included from measurements of the γ background of the room. (C.H.)

33645 AN ADAPTABLE WATER PHANTOM, DESIGNED FOR THE MEASUREMENT OF MOVING-BEAM DOSE DISTRIBUTIONS FOR INDIVIDUAL PATIENTS. J. Van de Geijn (Joannes de Deo Hospital, Hague). Brit. J. Radiol., 36: 611-12(Aug. 1963).

Design features are described of an adaptable water phantom for use in measurements of the radiation dose from a moving beam teletherapy source. A cross section of a particular patient, taken in the planned plane of rotation with the patient lying on the treatment table, is drawn on paper and fixed onto an auxiliary platform which fits over a series of Perspex plates designed to represent the patient's surface. A flexible rubber sack filled with water represents the section of the patient in the region of the plane of rotation, including the part of the treatment table involved. (C.H.)

33646 GENETICALLY SIGNIFICANT DOSE FROM RADIOTHERAPY IN THE NETHERLANDS, 1942-1951. P. J. L. Scholte, A. van Vianen, J. W. E. Vos, and J. Weber (Netherlands Inst. for Preventive Medicine, Leiden and Municipal Hospital "Zuidwal", Hague). Brit. J. Radiol., 36: 622-3(Aug. 1963).

A survey was made to determine the genetically significant dose to the population of the Netherlands from radiotherapeutic procedures for both non-malignant and malignant conditions. The total dose from both sources was estimated to be in the range of 4.1 to 7.1 mr/yr. The actual number of children born to the patients surveyed was 46% lower than the number expected for the average population. It is pointed out that the number of children might be reduced by disease, or factors other than radiation exposure alone. (C.H.)

33647 CARTESIAN DIVER RESPIRATOR FOR THE STUDY OF OXYGEN UPTAKE OF YEAST CELLS IRRADIATED BY X-RAYS. Nganshou Wai and Sung-Nien Lo. Bull. Inst. Chem. Acad. Sinica, No. 7, 1-25(Jan. 1963). (In English)

Respiration of a small number of cells may be demonstrated by the use of the Cartesian diver respirometer with an inclined manometer tube. The principle of the diver is simple and based on the compound density equation, but the techniques for preparing, filling, and immersing the diver require much experience. An equation was derived for the calculation of O_2 uptake. From the experimental results, it was found that the intact yeast cells were sensitive to x radiation. The O_2 uptake decrease might be used for the indication of the degree of damage incurred by the cells. When the dosage did not exceed the tolerance limit of the cell, there were various grades of radioinduced damage within the cell. The influence of temperature and pressure on the measuring system was quite evident. In order to compensate the experimental error, it was recommended to run a blank diver with another set of inclined manometer.

The Cartesian diver, when used as a respirometer, is somewhat superior to the Warburg manometer, because the respiration of a small number of cells may be demonstrated. (P.C.H.)

33648 FOLLOW-UP STUDY OF ADULTS TREATED WITH ROENTGEN RAYS FOR THYROID DISEASE. DeWitt S. DeLawter and Theodore Winship (Georgetown University Hospital, Washington, D. C. and Washington Hospital Center, Washington, D. C.). Cancer, 16: 1028-31 (Aug. 1963).

A group of adult patients treated by roentgen rays for diseases of the thyroid was followed to determine the possible carcinogenic effect of such radiation on the thyroid gland. This group was compared with a series of patients similarly treated during adolescence and with another group treated in childhood. A direct relation between roentgen therapy to the neck region and the subsequent development of thyroid cancer appears to exist in those treated in childhood and adolescence. The data now available suggest that the younger the patient when treated, the greater the possibility of the development of thyroid carcinoma. The data also indicate that the interval between radiation and the development of carcinoma is considerably less in children than in adolescents. Roentgen therapy does not appear to be a carcinogenic factor in adults. (auth)

33649 CHANGES IN S^{35} DISTRIBUTION IN ORGANS OF IRRADIATED MICE. V. Chmelar, V. Grossman, and M. Hodanova (Charles Univ., Hradec Kralove, Czechoslovakia). Cesk. Fysiol., 12: 210(May 1963).

Three hours after intravenous administration of 10 microcuries of S^{35}/20 g body weight, autoradiography revealed significantly lower level of S^{35} in blood, liver, and kidneys of mice that received 300 r than in controls. (OTS)

33650 EFFECT OF IRRADIATION OF MEDIUM ON GROWTH OF L-STRAIN CELLS. V. Puza, K. Lejsek, and A. Jelinek (Charles Univ., Hradec Kralove, Czechoslovakia). Cesk. Fysiol., 12: 211(May 1963).

When mouse fibroblasts were transplanted to a tissue culture medium that had previously been irradiated with 10000 r, the number of mitoses and bi- and poly-nucleated cells gradually decreased, indicating that such media deteriorate with irradiation as far as tissue culture suitability goes. (OTS)

33651 CHROMOSOMIC ABERRATIONS ASSOCIATED WITH THE HYPOMORPHOSES AFTER γ IRRADIATION OF THE EGG IN THE AMPHIBIAN URODELE PLEURODELES WALTLII MICHAH. Louis Gallien, Monique Labrousse, and Jean-Claude Lacroix (Faculte des Sciences, Paris). Compt. Rend., 256: 5413-15(June 17, 1963). (In French)

Fertilized eggs of Pleurodele exposed to the action of γ rays show chromosomic aberrations such as breaks and alterations. In the cases studied, these aberrations are associated with hypomorphoses. (tr-auth)

33652 CHROMOSOMIC ANALYSIS OF HUMAN MEDULLARY AND BLOOD CELLS AFTER IRRADIATION IN VITRO. Jean de Grouchy, Gabriel Vallée, Maurice Lamy (Hôpital des Enfants-Malades, Paris). Compt. Rend., 257: 278-81(July 1, 1963). (In French)

Chromosomic analysis of circulating blood leukocytes and of medullary cells cultivated 3 to 4 days after in vitro irradiation has confirmed the production of chromosome modifications consecutive to breaks. The much higher sensitivity of blood cells with respect to medullary cells was shown. The production of type K_1 and K_2 chromosomes, observed previously in cancerous cells, was observed. (tr-auth)

33653 EVIDENCE OF A RADIORESISTANCE OF SACCHAROMYCES CEREVISIAE DURING MITOSIS. Michel Dupin (Institut National de la Recherche Agronomique, Varsailles, France). Compt. Rend., 257: 282-4(July 1, 1963). (In French)

The radiosensitivity of Saccharomyces cerevisiae was studied after different time periods in sporulation medium. A very high radioresistance to γ rays was found in mitotic cells. On the contrary, no variation of resistance to ultraviolet irradiation was established. The sites attacked by these two radiations should be different. (tr-auth)

33654 ACTION OF RADIOACTIVE IODINE ON THE GESTATING MOUSE. STUDY OF THE EXPERIMENTAL DESTRUCTION OF THE THYROID OF THE MOTHER AND THE FETUS. Michel Delsol and Michel Berger (Faculte Catholique des Sciences and Faculte de Medicine, Lyon). Compt. Rend. Soc. Biol., 157: 470-2(1963). (In French)

The role of the embryonic thyroid in the mouse was studied by causing the destruction of the gestating mother and the fetus by injections of radioactive iodine. The mothers were injected with 14, 70, 170, and 190 mc of I^{131}. Histological examination of the mothers after birth showed that the thyroid was almost always injured. In a few animals receiving the smallest dose, however, no visible damage was observed. In the newly born mice of mothers receiving low-level injections, the thyroids appeared normal or at most marked only by images of hyperemia. Very sharp histological perturbations of the thyroid were observed in mice of mothers receiving high-level doses. A large number of still-births was obtained but the organogenesis showed neither histological nor anatomic perturbations. (J.S.R.)

33655 BIOLOGICAL EFFECTS OF IONIZING RADIATIONS ON THE GOLDEN CARP. P. Bonet-Maury (Institut du Radium, Paris). Compt. Rend. Soc. Biol., 157: 473-7(1963). (In French)

The radiosensitivity of the golden carp was studied after exposure to a 400 c Co^{60} source. The dose was varied between 1800 and 3000 rads/hr, and the absorbed dose was 500 to 200,000 rads. The fish were maintained in an aquarium at a temperature of 15 or 25°C. An abnormal pigmentation was observed at the end of a time period variable with the dose. The mean survival time decreases very sharply with the dose and at 5000 rads it is no more that 22 days. At doses above 100,000 rads some deaths were observed during irradiation. Increase of the temperature causes a reduction in the mean survival time. At 15° the $LD_{50/30}$ days is 3500 rads for Co^{60} γ rays. A preliminary series of experiments with x rays gave results analogous to those obtained with γ rays. For x radiation the mean survival time is 17 days at 15° for 10,000 rads and 7.1 days at 25°. (J.S.R.)

33656 NUCLEIC ACID CONCENTRATION AND RADIOSENSITIVITY OF THE SCORPION ANDROCTONUS AMOREUXI AUD. AND SAV. Xavier Pascaud and Pierre Niaussat. Compt. Rend. Soc. Biol., 157: 503-6(1963). (In French)

The concentration of desoxyribonucleic acid and of ribonucleic acid in the soft tissues was determined for the two invertebrates of the arid zone, the scorpion Androctonus amoreuxi Aud. and Sav. and the tenebrionide Pimelia angulata expiata Peyer. The radiosensitivity to γ rays had been previously determined: $LD_{50/30}$ days is 100,000 r for Androctonus and 40,000 for Pimelia. The mean rate of nucleic acids determined in the scorpion was relatively low. A possible relation between the high radioresistance

of the scorpion and the low nucleic acid concentration was discussed. (J.S.R.)

33657 LOCALIZATION OF 2-β-AMINOETHYLISOTHIOUREA IN THE CANCEROUS TISSUES OF THE MOUSE AND THE EFFECT OF THIS RADIOPROTECTOR ON THE RADIOLOGIC TREATMENT OF CANCERS. J. R. Maisin and A. Leonard (Centre d'Etude de l'Energie Nucleaire, Mol, Belg.). Compt. Rend. Soc. Biol., 157: 671-4(1963). (In French)

A study was made of the localization of 2-β-aminoethylisothiourea (AET) in spontaneous and grafted cancers in the mouse. AET, injected intraperitoneally, penetrates both spontaneous and grafted cancers. Preliminary results show that this compound protects the Ehrlich ascite tumor against x radiation. (tr-auth)

33658 SEQUELS OF IRRADIATION IN THE MOUSE C 57 BL: HEPATOMAS. D. J. Mewissen and J. H. Rust (Universite Libre, Brussels and Univ. of Chicago). Compt. Rend. Soc. Biol., 157: 680-2(1963). (In French)

The whole-body γ irradiation of C57 BL/6 mice causes a late appearance of hepatomas. Administration of cystamine before the irradiation does not seem to modify the carcinogenic effect of the γ radiation. The disease proceeds as if the hepatic oncogenesis was simply a tributary of a liminal dose. (tr-auth)

33659 ON THE RADIATION REACTION IN THE REGION OF CICATRIZED LUNG PROCESSES. W. Widow and R. Huber (Deutsche Akademie der Wissenschaften, Berlin). Deut. Gesundheitsw., 16: 573-80(Mar. 30, 1961).

The effect of radiotherapy on old tuberculous lung scars was investigated in 23 persons undergoing treatment for lung cancer. In most cases total Co^{60} x-ray doses of 2000 to 4000 r were given over a 2- to 3-week period, after which time cancer-bearing portions of the lung were surgically removed. Sections of the lung were examined histologically to determine particularly whether irradiation reactivated old tuberculous lesions. In 20 of the 23 cases, marked histologic changes, reflecting radiation pneumonitis, were observed, and in 8 cases tuberculous scar tissue was noted. Findings in these cases are described in detail. Except for one case, there was no evidence that irradiation exacerbated the tuberculous process; on the other hand, the radiation reaction appeared to be intensified in the vicinity of tubercles. (H.H.D.)

33660 HEALTH ASPECTS OF IONIZING RADIATION. Norman Simon (Mt. Sinai Hospital, New York). Diseases Nervous System, 24: Monograph Suppl., 55-60(Apr. 1963).

The relative significance of natural background radiation and that from diagnostic radiology in the causation of neoplasia and genetic effects is assessed. Sources of background radiation (terrestrial, cosmic, internal) are discussed and the biologic effects of radiation reviewed. Evidence for the carcinogenic and leukemogenic actions of radiation is evaluated. It is estimated that medical use of x rays formerly accounted for about half (100 mrad) of the annual gonad dose (including 100 mrad from natural background and 2 mrad from fallout). Some of the important factors that contributed to a recent decrease in the medical dose of radiation to gonads are as identified. It is concluded that natural background still provides most of the radiation exposure to man, that medical exposure accounts for ⅓ of the total exposure of man to radiation, and that fallout still represents only a small fraction of man's exposure to radiation. (TCO)

33661 EXPERIMENTAL MUTATIONS OF THE VEGETATIVE ORGANS OF ARBOREAL PLANTS. G. F. Privalov (Inst. of Cytology and Genetics, Academy of Sciences, Siberian SSR). Dokl. Akad. Nauk SSSR, 150: 661-4(May 21, 1963). (In Russian)

Thirty kinds of tree seeds were given a dose of 1 to 20 kr of γ rays, x rays, and fast neutrons. Observations were made on hundreds, or even thousands, of seedlings of one variety in order to determine the size and shape of the leaf, the leaf coloring, the angle of leaf growth, the rate of growth, and its resistance to cold. The greatest number of mutations were found in Acer negundo, Syringa vulgaris, Syringa Josikaea, Philadelphus pecinensis, and Populus nigra. The mutation rate was multiplied by a factor of 10 to 100 over the natural spontaneous mutation rate by treating the seeds with ionizing radiation. Examples of larger and faster growing plants were more frequently observed after treatment by irradiation. The leaf area in certain irradiated chimeric plants varied by a factor of three as compared to the controls. The formation of superficial fascia with subsequent division into two independent shoots was frequently observed in the irradiated plants. The production of mutants with an increased leaf surface can be useful in plant selection. (TTT)

33662 THE MECHANISM OF THE RADIOBIOLOGICAL LABILIZATION OF HEMOGLOBIN. E. A. Bauman. Dokl. Akad. Nauk SSSR, 150: 668-70(May 21, 1963). (In Russian)

Rabbits were given an x-ray dose of 900 r, and hemoglobin samples of the blood were modified by treatment with formaldehyde and oximes. The stability of the initial hemoglobin and of the chemically modified forms was estimated from the degradation of the hemoglobin in a buffered tartrate solution. The addition of formaldehyde blocking groups to the hemoglobin taken from irradiated rabbits led to stabilization of the hemoglobin molecule. Blocking with oxime groups was much less effective. Experiments on the recombination of heme molecules with the globin protein molecule showed that heme molecules combined more readily with native globin than with denatured globin. Treatment of the globin with the nitroprusside ion $[Fe(cn)_5NO]^{2-}$ or with oximes had very little effect on the recombination of heme molecules with globin, but treatment of the globin with formaldehyde led to a significant increase in the recombination rate. The formaldehyde molecules react with the basic amine groups in the globin molecule, but leave the carboxyl groups free to combine with the heme molecules. (TTT)

33663 THE EFFECT OF THE GROWTH HORMONE FROM THE ANTERIOR LOBE OF THE PITUITARY ON BONE UNDER CONDITIONS OF IRRADIATION. E. A. Ivanova (Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 150: 671-4 (May 21, 1963). (In Russian)

Young rats 3 to 4 days old were given an x-ray dose of 2000 r on the left hind leg. A daily dose of 200 γ of growth hormone obtained from the pituitary of a bull was administered, until the animals were killed on the 36th, 41st, and 44th days after the irradiation. The length of the tibia in the left and right legs was determined by x rays. In the irradiated animals, the ratio of the length of the left tibia to the right tibia was about 0.50, and the introduction of growth hormone into the rat had only a slight effect on tibial growth. The bones were then fixed in a Zenker-formalin fluid, and cytological studies were carried out. These studies show that irradiation of the extremity of a four-day rat with an x-ray dose of 2000 r resulted in deep disturbances in the cartilage bone with subsequent arrest in the development of the bone. The introduction of growth hormone ameliorated the changes in bone structure, but did not result in normal bone development. (TTT)

33664 THE FREQUENCY OF DEVELOPMENT OF LUNG ADENOMAS IN MICE AS A FUNCTION OF THE EXTERNAL GAMMA DOSE. R. V. Smirnov (Central Research Inst. of Medicinal Radiology, USSR). Dokl. Akad. Nauk SSSR, 150: 675-6(May 21, 1963). (In Russian)

White female mice were given Co^{60} gamma doses of 100, 200, 400, 600, and 800 r. Observations were carried out on the mice until they died, after which they were autopsied and examined for lung adenomas by histological fixation of lung material and staining with hematoxylin-eosin. The adenomas were grayish, and 1 to 7 mm in diameter. The results showed that the frequency of occurrence of adenomas was the same for the control group as for the groups irradiated with a dose of 100 r or 200 r. A slight decrease in the frequency of adenomas occurrence was observed at higher doses, but the result was not reliable. The results indicated that there is no change in the frequency of occurrence of lung adenomas under conditions of whole-body irradiation. However, local irradiation of the lungs can cause an increase in the number of adenomas at high doses. (TTT)

33665 FACTORS AFFECTING THE RESTORATION OF REGENERATIVE CAPACITY IN THE EXTREMITIES OF AXOLOTLS (LARVAL SALAMANDERS), WHICH HAD BEEN SUPPRESSED BY X-RAY IRRADIATION. L. V. Polezhaev, N. A. Teplits, and S. Ya. Tuchkova (Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 150: 694-7(May 21, 1963). (In Russian)

A total of 160 axolotls were given an x-ray dose of 8000 r to both hind extremities. Amputation of the legs was carried out 2.5, 3, and 6 months after the irradiation, and preparations containing RNA, DNA, or protein were injected into the right hind extremity or into the muscles of the back. The controls were not treated after amputation. Regeneration of the extremity took place in 13% of the cases with amputation 3 months after the irradiation, and in 23.3% of the cases with amputation 6 months after the irradiation. However, with repeated amputation, regeneration took place in 53 to 77% of the cases 6 months after the irradiation. Thus, the factor of shock was more important than the factor of time in restoring regenerative capacity. Commercial RNA and DNA were ineffective. High-molecular-weight RNA prepared in the laboratory, and protein preparations were effective in restoring regenerative capacity of the extremities, but the RNA lost its activity on storage for a month and a half. Salamanders given a whole-body, x-ray dose of 1000 r and treated with RNA showed a 37% increase in life span as compared to the controls which were not treated with RNA. (TTT)

33666 REDUCED RESISTANCE TO TUMOR FORMATION IN IRRADIATED ORGANISMS AT A CONSIDERABLE PERIOD OF TIME AFTER THE EXPOSURE. N. V. Kozlova (Central Research Inst. of Medicinal Radiology, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 150: 916-19 (June 1, 1963). (In Russian)

White mice were given a single, whole-body, Co^{60} dose of 200 r. Five intraperitoneal injections of a 0.1 ml of a 10% urethan solution at three day intervals were administered to the irradiated mice on the 4th and 6th month after the irradiation. The same dosage of urethan was given to the control group of unirradiated mice. Since maximum development of adenomas takes place three months after injection of urethan, all mice were killed three months after the first injection of urethan, and the lungs were removed to determine the formation of adenomas. On injecting urethan four months after the irradiation, tumors were observed in both lungs in 100% of the irradiated mice, but only 85% of the time in the right lung and 75% of the time in the left lung with the control mice. A total of 559 tumors were detected in 35 irradiated mice, while only a total of 76 tumors were found in 20 control mice (a four-fold difference in frequency rate). The average weight of adenomatous tissue in the irradiated mice was a factor of 14.5 greater than the weight of adenomatous tissue in the lungs of the control mice. The results were similar on injecting the carcinogenic agent six months after irradiation. (TTT)

33667 THE EFFECT OF GAMMA IRRADIATION ON ONION GROWTH AND NUCLEIC ACID CONTENT. N. P. Korableva and L. V. Metlitskii (Bakh Inst. of Biochemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 150: 1153-6(June 11, 1963). (In Russian)

Gribovskii onion bulbs (a turnip-like onion) were given a dose of 10, 100, and 300 kr in November, while the bulbs were still in a state of rest. The irradiated bulbs were stored at a temperature of 2°C and a relative humidity of 85 to 90%, and were planted in February and March of the next year (1962). Samples of various parts of the plant were taken for morphological and biochemical study. Microscopic analysis of the leaves and onion bulb given a dose of 100 kr showed the absence of normal dividing cells. The increase in the size of the leaves and bulb were due to cell expansion rather than to cell division. A dose of 3 to 10 kr retarded the synthesis of nucleic acids in the irradiated plant during storage. After sprouting, the nucleic acid content in the root system increased by a factor of 2 to 3 in the plant irradiated up to a dose of 100 kr and in the control. The total nucleic acid content in the onion bulb given a dose of 300 kr decreased, and this decrease could be correlated with the almost complete suppression of growth at this dose. The results showed that the onion is more resistant to irradiation than is the potato tuber. (TTT)

33668 GENETIC CONSEQUENCES OF THE ACTION OF FAST NEUTRONS ON THE SEXUAL CELLS OF MALE MICE. M. D. Pomerantseva and L. K. Ramaiya (Inst. of Genetics, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 151: 203-5(July 1, 1963). (In Russian)

The effects of fast neutrons on the sexual cells of 2.5 to 4-months old male mice were investigated using the appearance of dominant lethal mutations in the spermatids and the spermatozoid cells as criterion. The animals were exposed to a 1-Mev average energy fast-neutron beam in the horizontal beamhole of an IRT-type reactor, using the ionization method for dosimetric measurements. The dose rate used amounted to 700, 314, and 258 rad/hr, with an associated γ radiation rate of 100, 86, and 70.5 rad/hr. Total fast-neutron doses of 17, 34, 57, 114, 171, and 228 rad were used. The irradiated animals were mated with unirradiated females, determining the number of yellow bodies in the ovary, the implantations in the uterus and the number of viable embryos. The results indicated that an increase of the fast neutron dose caused an increase in the number of the embryos lost. The following exponential correlation could be determined between the appearance of lethal mutations and the fast neutron dose: $f(D) = 1 - e^{-mD}$, in which D designates the dose and m the probability of the appearance of a dominant lethal mutation in a sexual cell per unit dose. This rate was found to be, in average, 6.0×10^{-3}. The results indicated that the relative genetic effectiveness of fast neutrons on the spermatozoid cells is about 4 times higher than that of the x rays. (TTT)

33669 THE DYNAMICS OF THE POSTIRRADIATIVE REGENERATION OF YEAST CELLS AS A FUNCTION OF THE γ-RADIATION DOSE. V. S. Barsukov, O. V. Malinov-

skii, and N. M. Mityushova (Pavlov Inst. of Physiology, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 151: 209-12(July 1, 1963). (In Russian)

The dynamics of the regeneration of genetically similar strains of haploid, diploid, and tetraploid strains of Saccharomices cerevisiae as a function of the γ dose was studied for the purpose of determining the recovery mechanism. The yeast cells were exposed in an aqueous suspension to the γ radiation of 1500 rad/min Co^{60} source. Five days later the number of macrocolonies in the agar culture were determined and the results compared with those obtained with unirradiated specimens. The number of colonies which preserved the ability of unlimited reproduction was determined. It was found that the yeast cells may be arranged in the following order on the basis of their radiation sensitivity and regenerative ability: haploid, diploid, and tetraploid. It was found that the duration of the process does not affect the rate of recovery. Regeneration does not depend on the number of primary genetic injuries of the cells; on the other hand, the rate of regeneration decreases with increasing dose. This seeming contradiction is explained by pointing out that in the case of irradiation of the cells, in addition to injury to the unique genetic structure which depresses the unlimited reproductive capacity of the cells, the massive cytoplasmic structure is also damaged. (TTT)

33670 REPARATIVE REGENERATION OF THE LIVER OF THE RAT AFTER LOCAL EXPOSURE TO X RADIATION. M. M. Kalashnikova (Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 151: 213-16(July 1, 1963). (In Russian)

The effect of local irradiation on the regenerative power of the liver was investigated on male white rats. The animals were subjected to a single, 1000-r irradiation of the liver. One day after the exposure an operative injury was made at the right side of the liver; operated but not irradiated and irradiated but not operated animals were used as control. Comparison of the results obtained with the various series showed that exposure of the liver to 1000 r causes the formation of small necrotic centers, vacuolization of the cytoplasm, disturbances in the cell structure and atypical mitoses; therefore the liver cannot be considered a radiation-resistant organ. The effect of radiation during regeneration after partial hepatectomy is manifested in the slowing down of the leukocytic reaction, appearance of atypical mitoses, and in the case of young animals, by edema; all these reactions tend to slow down the recovery process. The animals with a liver which was partially hepatectomized after irradiation did not exhibit vacuolization of the cytoplasm and the cell structure was disturbed to a lesser extent. This might be to the fact that plastic processes involved in the regeneration of the liver weaken the development of pathological processes. (TTT)

33671 INVESTIGATION OF THE PROTECTIVE ACTION OF CYSTAMINE ON THE ASCITIC EHRLICH CARCINOMA CELLS, IRRADIATED IN VIVO AND IN VITRO. I. V. Nekrasova (Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 151: 217-19 (July 1, 1963). (In Russian)

The nature of the radioprotective action of cystamine (2-aminoethyl disulfide) is still not clarified. The problem was further studied by comparing the effect of cysteamine and cystamine on the ascitic Ehrlich carcinoma (hyperdiploid strain), irradiated in the abdominal cavity of the mouse and outside of the organism. Seven days after implantation of the tumor cells, the animals were exposed to a single dose of 400 or 700 r of x radiation at a dose rate of 50 r/minute, both under addition of cysteamine and cystamine and without the protective agents. The results showed that both agents reduce the number of cells exhibiting chromosomic rearrangement to about the same level in the in vivo irradiation experiments. However, only the cysteamine exerted a protective action in the case of irradiation of the tumor cells outside of the organism; its radioprotective effect was about the same as in case of in vivo tests. The cystamine in ascitic liquid outside of the organism did not noticeably affect the radiation injury. This is probably due to the fact that the radioprotective action of the cystamine is caused by its overall pharmacological effect on the organism, resulting in tissue hypoxia and therefore cannot be noted at the cell level. (TTT)

33672 THE ACTION OF X IRRADIATION ON EMBRYONIC DEVELOPMENT OF THE MOUSE. Heinz Kriegel, Hanns Langendorff, and Irmela Kunick (Universität, Freiburg i. B.). Embryologia (Nagoya), 6: Suppl., 291-318(Mar. 1962). (In German)

Pregnant mice were irradiated on the 5th to 13th day of gestation by a single, whole-body, 200-r dose of x rays, and fetal mortality and anomalies were investigated. Irradiation had least influence on the developing organism when given at early or late developmental stages; little effect was noted in fetuses irradiated on the 5th or 13th day of gestation. Almost 100% of the fetuses showed deformities when irradiated on the 7th to 11th days, the 11th day being the most critical time of exposure. Resorption of fetuses reached a max of 60% between the 7th and 9th days of gestational exposure. Max incidence of deformities of the brain occurred after irradiation on day 7.5 (54% incidence), of eye on day 7.5 (78%), of nose and snout on day 8 (39%), spinal cord on day 7.5 (1.2%), sternum on day 6 (4%), extremities on day 11 (9%), feet on day 11 (97%), tail on day 10 (87%), abdomen on day 7.5 (22%), and thorax on day 7 (1.7%). Thus the nervous system is most sensitive to radiation at an early stage of organogenesis (7–8th day of gestation), while the skeletal development is most sensitive later (11th day). Greatest impairment of fetal wt. was observed after irradiation on the 11th day; in this case wt. of 18-day fetuses was only 80% of that of nonirradiated controls. These results are very similar to those previously obtained in the rat. (H.H.D.)

33673 RADIATION RESPONSE OF MAMMALIAN CELLS GROWN IN CULTURE. III. MODIFICATION OF X-RAY SURVIVAL OF CHINESE HAMSTER CELLS BY 5-BROMODEOXYURIDINE. W. C. Mohler and M. M. Elkind (National Cancer Inst., Bethesda, Md.). Exptl. Cell Res., 30: 481-91(1963).

Chinese hamster cells (strain V79-1) cultured in vitro show an increased response to the lethal effects of x rays when they are grown prior to irradiation in 5-bromodeoxyuridine (BUDR). These cells appear to be more sensitive than the human cell line, D98/AG, to the radiation modifying as well as the cytotoxic effects of BUDR. BUDR produces a striking change in the extrapolation number of x-ray survival curves of V79-1 as well as the change in slope reported in D98/AG. Both of these changes appear to be the result of alterations in cellular radiation response and not the result of population heterogeneity. When cells having an increased x-ray response induced by BUDR are removed from contact with BUDR, they reassume x-ray survival parameters similar to normal cells within one or two generations. (auth)

33674 X-RAY-INDUCED SKIN CANCER IN MAN. Herbert L. Traenkle (Roswell Park Memorial Inst.,

Buffalo). First Internat. Conf. Biol. Cutaneous Cancer, Philadelphia, Pa., Apr. 1962: 423-32(1963).

Development of cancer in human skin exposed to ionizing radiation is considered in terms of cell type of the observed tumors, relation between dose and effect, and mechanism of carcinogenesis. Human skin exposed to ionizing radiation may develop squamous-cell and basal-cell carcinoma, occasionally sarcoma, and perhaps rarely, malignant melanoma and sebaceous carcinoma. The dose range required for radiation carcinogenesis in man is not precisely known. While a definite threshold dose cannot be demonstrated, it appears that carcinoma does not commonly develop in the absence of late sequelae. In most cases, skin cancer develops from chronic lesions resulting from repeated irradiation giving high total doses. These changes are not usually produced with total doses below 100 r. The upper limit of the carcinogenic range seems to be below the dose level used for cancer therapy. The mechanism of the genesis of radiation-induced carcinoma appears to be exceedingly complex. However, a considerable body of evidence suggests that perhaps at least two general tissue responses are involved, direct and indirect. These direct and indirect mechanisms operate in the production of radiation-induced cancer of the human skin; there is a possibility that in addition to radiation, other factors, as yet undefined, may exert a synergistic or cocarcinogenic effect. (H.H.D.)

33675 QUANTITATIVE STUDY ON INTERACTIONS OF CELLULAR GRAFTS IN MOUSE RADIATION CHIMAERAS. Alena Lengerová (Inst. of Experimental Biology and Genetics, Czechoslovak Academy of Sciences, Prague). Folia Biol. (Prague), 9: 196-202(1963). (In English)

Lethally irradiated mice were given a curative dose of fetal liver cells of two different genotypes. By varying the conditions of administration of the two cell grafts, their relative capacity to repopulate the host bone marrow was made assessable. In the first experiment, changing the relative proportions of $(CBA \times T6T6)F_1$ and $(CBA \times A)F_1$ cells in the restorative inoculum from 8:2 to 2:8 did not markedly affect the proportions of these two cell types in the bone marrow of 200-day-old CBA chimeras, the majority of dividing cells in all four experimental groups being of $(CBA \times T6T6)F_1$ origin. Coexistence in the chimeras of two cell populations differing antigenically from each other indicates graft-to-graft tolerance; under this condition an immune mechanism can scarcely be held responsible for the interactions of both cell populations and differential physiological capacity is to be inferred. In another experiment the result of competitive repopulation was more easily upset by varying the conditions by the start. The irradiated recipients were A strain mice, and the fetal liver cells were of ASW and CBA origin. The two restorative cell grafts were given either both intravenously or one of them intravenously and the other intraperitoneally or subcutaneously. Graft-to-graft tolerance was tested by challenging the survivors with both ASW and CBA skin grafts. If both types of cells were given intravenously, the CBA genotype appeared physiologically superior to ASW, for the results of skin-grafting pointed to the capacity of CBA cells to overgrow a double size inoculum of ASW origin. If the CBA cells were given by a non-intravenous route, the result of the competition was reversed in favor of the ASW genotype. The possible role of immune and non-immune factors is discussed. (auth)

33676 ANTIBODY FORMATION BY CELLS ISOLATED FROM DONORS OF DIFFERENT AGES AFTER TRANSFER TO YOUNG RABBITS AND TO X-IRRADIATED ADULT RABBITS. J. Sterzl (Inst. of Microbiology, Czechoslovak Academy of Sciences, Prague). Folia Microbiol. (Prague), 8: 69-79(Mar. 1963). (In English)

To study the first phase of antibody formation by isolated cells, a method was developed for transferring isolated lymphoid cells stimulated by antigen in vitro. Antibody formation by spleen cells isolated from adult, nonimmunized donors and mixed with Brucella suis antigen was compared after transfer to young rabbits and to adult recipients irradiated with 450 r. It was found that this dose did not produce complete inhibition and that the recipients still responded actively to the antigen. Therefore, only young animals are a suitable experimental model in which to study antibody formation by transferred isolated cells. Development of antibody in young rabbits was studied by transferring cells isolated from the spleen of animals aged 8-30 days and mixed with antigen in vitro. Antibodies were formed after the transfer of these cells to x-irradiated recipients, but by the active response of the latter to the antigen. Antibody formation by cells of donors of different ages can be determined after transfer to young animals. The youngest donors whose cells formed antibodies after transfer were 3-week-old rabbits, but demonstration of antibodies required the transfer of large numbers of cells. It is clear from these results that cells from adult donors which have contacted antigen in vitro form antibodies when transferred to homologous newborn recipients. However, newborn rabbits are functionally too active to be altogether ideal and suitable recipients. The newborn destroy transferred cells within a few days, thus abolish their immunological activity. The discrepancy between the finding that antibodies can be obtained in young animals immunized soon after birth and failure of their isolated cells to perform the same function may be due to several factors. It is suggested that direct immunization experiments, using different antigens, may provide a more accurate answer. (H.H.D.)

33677 THE GENETICAL CONTROL OF RADIOSENSITIVITY. I. SEEDLING CHARACTERS IN TOMATO. D. Roy Davies (Wantage Research Lab., Berks, Eng.). Heredity, 17: 63-74(Feb. 1962).

Examination of data from a set of diallel crosses between a number of inbred lines was used for analysing the genetic control of radiosensitivity in six tomato varieties. The six varities were crossed in all possible combinations, including reciprocals, and the parental and F_1 seed were used in the experiments. Seeds were dried and exposed to 28,116 rad of Co^{60} γ rays at a rate of 2000 rad/hr. The characters scored were the distance from the apex of one cotyledon to the apex of the other at the 12th day, and the lengths of the 1st and 2nd leaves at the 19th day after sowing. The results showed the response of tomato seeds to radiation to be genetically controlled. The nature of this control was polygenic, with evidence of additivity and dominance. The different varieties had various proportions of dominant and recessive alleles, and dominance and ambidirectional. Pronounced consistent and inconsistent maternal effects influenced the radiation response; these affected dominance values to produce a complex genetic situation. The genetic control of radiosensitivity was different from that of the simple growth characters, though there was some similarity in that both showed maternal effects. There was also evidence that the control of these characters varied according to whether they were measured in the cotyledon, first or second leaf. Relationships between spontaneous mutation and chromosome breakage, and induced mutation and breakage is discussed.

It is concluded that radiosensitivity per se may not be a true character, and that what was measured may be some quite different character, which could control such factors as oxygen tension, metabolic rate, or production of radioprotective substances; and that different levels of expression of this character could result in different levels of radiosensitivity. (H.H.D.)

33678 INFLUENCE ON COSMIC FLIGHT FACTORS ON THE FORMATION FREQUENCY OF RECESSIVE FLYING MUTATIONS IN DROSOPHILA MELANOGASTER. Ya. L. Glembotskii, G. P. Parfenov, and Yu. A. Lapkin. Iskusstv. Sputniki Zemli, Akad. Nauk SSSR, No. 15, 113-19(1963). (In Russian)

The influence of cosmic flight conditions on the frequency of mutations in Drosophila melanogaster was investigated. The data were obtained during the following flights: the fourth and fifth Sputniks, Vostok, and Vostok-2. These results together with earlier data are presented in a table where a total of 34 sets of varying flight conditions are listed. A large spectrum of mutations induced by flight conditions are found. Out of 34, 30 sets of conditions showed an increase in mutations over control specimens. In 13 of these cases the increase in mutations was far above any possible statistical fluctuations. It is pointed out that from the existing results no differentiation can be made between the specific influence of the increase in gravity during acceleration, ejection, weightlessness, cosmic radiation, and the interaction of these factors with one another. (TTT)

33679 CHEMICAL PROTECTION AND CHEMORESUSCITATION OF ULTRAVIOLET-IRRADIATED SHIGELLA SONNEI. Marius G. Peacock and Mitsuru Nakamura (Montana State Univ., Missoula). J. Bacteriol., 86: 161-2(July 1963).

The radiation protective qualities of adenylic acid, guanylic acid, uridylic acid, uridine, uracil, adenine dinucleotide, and adenine triphosphate on Shigella sonnei were studied. Bacterial cells were treated with a chemical compound and given an ultraviolet dose of approximately 969 ergs/mm^2. Chemoresuscitation was studied by irradiating cell suspensions and incubating the cells for 24 hr in phosphate buffer containing the test compound. It was found that adenylic acid, uridylic acid, uridine, uracil, and adenosine triphosphate restored the vitality of the cells. Chemoresuscitation was not so pronounced as chemical protection. Chemoresuscitation mechanisms are discussed. (H.M.G.)

33680 STUDIES ON THE GAMMA RAY IRRADIATION ON THE PROTEIN. II. THE ESR ABSORPTION OF PROTEINS, AMINO ACIDS, AND PEPTIDES. Yasuo Imai (Kyoto Univ.). J. Biochem. (Tokyo), 50: 284-92(Oct. 1961). (In English)

Co^{60} irradiation of proteins was carried out at a rate of 3000 r/min in vacuo or in an atmosphere of oxygen or nitrogen. The electron spin resonance (ESR) absorption spectra of irradiated bovine and human serum albumin, fibrin, and silk fibroin were determined. It was shown that the free radicals in the irradiated proteins are associated with their cystine or cysteine content. The higher the content of these sulfur-containing amino acids in irradiated proteins, the more their ESR patterns resemble those of cystine and cysteine. Irradiated silk fiber provided a doublet similar to that of glycyl-glycyl-glycine. Such an orientation-dependent pattern could be explained as an unpaired electron localized on the oxygen atom hydrogen-bonded to the NH group of the adjacent polypeptide chain. When irradiation was done in the presence of oxygen, the ESR signals of proteins were markedly different from those irradiated in vacuo, the former being attributable to peroxide radicals. Proteins irradiated in the presence of water barely provided a detectable ESR signal. When irradiated albumin or cysteine were dissolved into the solution of native albumin, the titrable SH group decreased, probably due to reaction of sulfhydryl radicals with the SH group. It is concluded that the effect of radiation on protein solutions is chiefly, if not entirely, attributable to radicals from the irradiated water, and that the decrease in the SH group of irradiated protein solution can be partly ascribed to free radical reactions. (H.H.D.)

33681 THE EFFECT OF TEMPERATURE UPON THE DEVELOPMENT OF X-IRRADIATED EAR GRAFTS IN AMBLYSTOMA. Jean Piatt (Univ. of Pennsylvania, Philadelphia). J. Exptl. Zool., 149: 59-73(Feb. 1962).

A previous study indicated that the eventual development of x-irradiated ear grafts in Amblystoma is less abnormal when the host embryos are kept at 8°C for the first 4 days following irradiation than when maintained continuously at 20°. Additional experiments dealing with effect of postirradiation temperature upon the development of irradiated ear vesicles in Amblystoma are reported. Embryos were x irradiated at stages 25 and 29 with 1000 r, and the right ear rudiment of irradiated embryos was transplanted orthotopically to nonirradiated embryos of the same stage 10 to 70 min following irradiation. Immediately after healing of the graft the host embryos were kept at 8° for 7 days and subsequently maintained at 20°, kept at 14° for 7 days and subsequently maintained at 20°, or maintained continuously at 20°. When grafts were examined 35 days after transplantation, development of the mature ear grafts irradiated at stage 25 was deficient in all three series. Mature grafts irradiated at stage 29 differed in no essential way from those irradiated at the earlier stage except that development in all the series was more uniformly poor. However, when examined at 7 days, the time temperature differentials were terminated, the ear grafts irradiated at either stage 25 or 29 manifested definite signs of radiation damage in all 3 series. Size, differentiation, and mitotic activity were all adversely affected in all 3 series. Exposure to 1000 r is lethal to embryos irradiated at either stage 25 or 29. This was true of the 8° and 14° series as well as the 20° series. However, within the temperature ranges used, length of survival was progressively greater at lower temperatures in both groups. Regardless of temperature after exposure, embryos irradiated at stage 29 lived ~ 3 days longer than those irradiated at stage 25. Thus, contrary to earlier studies, these experiments afford no evidence that temporary hypothermia following exposure to x rays protects developing ear grafts in Amblystoma from radiation damage, although survival of irradiated embryos is prolonged for several days by keeping them temporarily at lower temperatures following irradiation. It is concluded that the negative results of postirradiation hypothermia obtained in irradiated ears do not necessarily conflict with the positive effects upon survival obtained by lower temperatures, since the 2 sets of data derive from different standards of measurement and cannot be compared with each other directly. (H.H.D.)

33682 ANAEROBIC GROWTH AS A FACTOR INFLUENCING RADIOSENSITIVITY. Brenda Hodgkins and Tikvah Alper (Hammersmith Hospital, London). J. Gen. Microbiol., 30: 307-15(Feb. 1963).

To investigate the nature of the radiosensitizing effect

of oxygen, studies were conducted on uv- and x-irradiated cultures of Escherichia coli (strain B and its mutant B/r) under anaerobic and aerobic conditions. Anaerobic growth of strain B after uv or x irradiation decreased lethal damage, the treatment being most effective after uv and more effective after x rays delivered in the absence than in the presence of oxygen. In this respect, anaerobic growth corresponded with a variety of inhibitory conditions after irradiation, and rescue by anaerobic growth was about as effective as chloramphenicol treatment, but when these two treatments were used together, the effectiveness of each was decreased. The effects of uv and x radiation on E. coli B/r were unchanged by anaerobic growth after irradiation, but anaerobic growth beforehand resulted in survival curves which were much more sigmoid in shape than those pertaining to aerobically grown organisms. This tendency was noted with all strains tested. Anaerobic growth before x irradiation did not alter the effect of oxygen during irradiation. Anaerobiosis and no effect on E. coli K 12(λ) or K 12S after uv irradiation. Salmonella typhimurium was affected like E. coli B, but to a lesser extent. It is suggested that all rescue treatments enable the organisms to by-pass damage to a particular site, but that the mechanism may be different with different treatments. The kinetics of rescue by chloramphenicol or by puromycin differ from those observed with other treatments. Thus, preliminary aerobic incubation decreased the effectiveness of subsequent anaerobiosis; similarly, a preliminary period of normal protein synthesis decreased the effectiveness of subsequent specific inhibition. Since there was no additivity in the rescuing effect of chloramphenicol and anaerobiosis, and these two treatments in fact counteracted each other, it is suggested that two different pathways of rescue from radiation damage may interfere with each other. (H.H.D.)

33683 HYDROLYSIS OF IRRADIATED OVALBUMIN BY PEPSIN. Hector A. Dieu and V. Desreux (Université, Liège). J. Gen. Physiol., 45: No. 4, Suppl., 179-84(Mar. 1962).

Crystalline ovalbumin was irradiated with three doses (6.5, 25, and 40 Mrad) of Co^{60} γ rays under high vacuum. Native and irradiated samples of the protein were then hydrolyzed by pepsin at pH 1.4, after centrifugation of the aggregated material, and the number of bonds broken per ovalbumin molecule estimated by comparing the rate of protein destruction with the rate of formation of NH_2 groups. Both rates increased markedly with the dose, but the number of bonds broken decreased. Sedimentation measurements showed drastic changes in molecular shape of the soluble fraction after 25 and 40 Mrad. The observed increase in asymmetry was related to the increased rate of attack on γ-irradiated ovalbumin by pepsin. Infrared spectra of the aggregates showed only small differences from those of the native samples. These differences involve the general shape of the very large stretching vibrations of NH and CO groups. However, in the aggregated insoluble material obtained after centrifugation and lyophilization of irradiated samples, disappearance of the 1400 cm^{-1} CH_2 deformation vibration was noted. (H.H.D.)

33684 IRRADIATED PARASITIC WASPS: THE EFFECT ON PROGENY PRODUCTION AND SEX RATIO. Paul DeBach and Ernest B. White (Univ. of California, Riverside). J. Heredity, 53: 271-6(Nov.-Dec. 1962).

An effort was made to increase the genetic variability of laboratory populations of the diaspine scale parasite Aphytis lingnanensis, in order to increase the probability of successful artificial selection of a parasite strain with improved tolerance to temperature extremes. Thus studies were made on the effects of x irradiation on the longevity of mated adult females, and on the numbers and sexes of their progeny as well as an evaluation of the susceptibility of the species to irradiation. The numbers of progeny surviving to become F_1 adults (termed net fecundity) served as a criterion of the production of lethal mutations, chromosomal aberrations, and somatic effects. Irradiation of adults at doses of 250, 500, 1000, 2000, and 4000 r produced: no effect on longevity of treated adults, pronounced reduction in net fecundity with increasing x-ray dosage, indications that mature eggs were less affected by x-ray treatment than the less mature ones, and sharply reduced percentage of females in the progeny of those groups which received the highest dosages. Thus the percentage of females among the progeny of irradiated female parasites was drastically lowered by 2000 and 4000 r, but no clear indication of an effect on sex ratio was evident at the 250, 500, or 1000 r. Possible explanations of the lowered female productivity phenomena are offered. (H.H.D.)

33685 CARCINOMA OF THE LUNG IN RATS EXPOSED TO THE β-RADIATION OF INTRABRONCHIAL RUTHENIUM^{106} PELLETS. I. DOSE-RESPONSE RELATIONSHIPS. Sidney Laskin, Marvin Kuschner, Norton Nelson, Bernard Altshuler, John H. Harley, and Marshall Daniels (New York Univ., New York and Atomic Energy Commission, New York). J. Natl. Cancer Inst., 31: 219-31(Aug. 1963).

Groups of rats were exposed to β radiation derived from ruthenium^{106}-plated pellets implanted within the bronchi. Levels of μc varied from 0.008 to 13.6 and integrated dose from 10^3 to 10^6 rads. Since the spatial relationship of the emitting pellet to the bronchial origin of tumor was known, dose to the specific target tissue could be directly calculated. This is in contrast to previous quantitations of radiation to the bronchus in terms of average lung dose. Sixty-eight animals with squamous cell carcinomas were observed among the 265 rats exposed. The tumors occurred in dose-related fashion with incidence progressing from 7.3 percent in animals exposed to 10^3 rads to 65.6 percent in those exposed to 10^6 rads. (auth)

33686 FURTHER STUDIES OF THE INFLUENCE OF DIET ON RADIOSENSITIVITY OF GUINEA PIGS, WITH SPECIAL REFERENCE TO BROCCOLI AND ALFALFA. Doris Howes Calloway, Gordon W. Newell, W. K. Calhoun, and A. H. Munson (Armed Forces Food and Container Inst., Chicago). J. Nutr., 79: 340-8(Mar. 1963).

Earlier studies showed that supplementation of a bran and oats diet with cabbage decreased the radiosensitivity of guinea pigs. Attempts were made to elucidate the dietary factors conferring radioprotection on guinea pigs. After maintenance on various diets, they were exposed to 350-rad of Co^{60} γ radiation or 400-r of x radiation. Whole-body exposure to either x or γ radiation resulted in almost total mortality within 10 to 15 days among young guinea pigs fed a basal diet of bran and oats plus ascorbic acid. It was shown that supplementation with alfalfa, broccoli, and other plant materials high in content of β-carotene, for 2 weeks before irradiation and during 20 to 30 days after irradiation, consistently reduced mortality. Other diets showed marginal or no beneficial effects. Supplementation of the bran-oats diet with pure vitamin A or β-carotene extended survival time but did not appreciably influence radiation-induced mortality. Guinea pigs fed an adequate purified diet were more resistant to radiation injury than those given the bran-oats basal diet. Supplementation of the

adequate purified diet with broccoli or alfalfa did not consistently affect radiosensitivity under these conditions. The beneficial effect of raw broccoli could not be duplicated by feeding the bran-oats diet supplemented with a mixture of 48 chemically pure ingredients patterned upon the composition of broccoli. The radioprotective agent in alfalfa is water-soluble and is destroyed upon ashing. Two hypotheses are offered to account for these responses. First, the bran-oats diet may impose a requirement which does not exist with the purified diet, either due to the presence of some substance detrimental to absorption or to a specific nutrient imbalance. Alternatively, an unrecognized essential substance may be provided by both green plant materials and some ingredient of the purified diet. (H.H.D.)

33687 GAMMA IRRADIATION OF BACILLUS SUBTILIS SPORES. A. M. Cook and T. A. Roberts (London Univ.). J. Pharm. Pharmacol., 15: 345-6(May 1963).

When aqueous suspensions of Bacillus subtilis spores were exposed to Co^{60} γ irradiation and subsequently stored at 0° and 20°C, survival was greater at 20° than at 0°. Slopes of the lines relating dose to numbers of survivors were not parallel, but converged at ~ total survival at 0 dose of radiation. Thus spores subsequently stored at 20° survived larger doses of radiation than the spores subsequently stored at 0°. When an aqueous suspension of B. subtilis spores was heated at 60°C for 3 min, 60° for 15 min, or 90° for 5 min, there was a progressive increase in the number of spores which produce colonies on agar plates. But if a second sample of the spore suspension was first irradiated and then heated in the same way, there was a decrease in the number of spores producing colonies on agar plates. The results indicate that pre-irradiation sensitizes B. subtilis spores to a degree of heating normally sublethal and used to activate dormant spore suspensions. (H.H.D.)

33688 EVIDENCE FOR A POSSIBLE ROLE OF ENDOGENOUS CATECHOLAMINES IN THE VASCULAR CHANGES PRODUCED IN RAT INTESTINE BY X RAYS. D. A. Willoughby (University Coll., London). J. Pathol. Bacteriol., 83: 389-97(Apr. 1962).

After exposure of rat abdomen to a 1000-r dose of x rays the intestinal vessels developed increased permeability to circulating protein-bound trypan blue, first demonstrable at 24 hr, reaching a max by 72-96 hr after irradiation, and thereafter slowly returning to normal. Pretreatment of rats with the monoamine oxidase (MAO) inhibitor iproniazid (250 mg/kg before and 125 mg/kg 24 hr after irradiation) led to striking suppression of the accumulation of trypan blue in the intestine, most marked at 24 hr. Compound HP 1275 (1-methyl-2-phenoxyethylhydrazinium, 200 mg/kg) was the most effective MAO inhibitor tested in reducing intestinal capillary permeability after abdominal irradiation. Similarly, HP 1273 (2,4'-hydroxphenoxyethylhydrazinium) and pheniprazine each caused a marked reduction (68 and 50%, respectively) of the dye-leakage measured 48 hr after irradiation. To eliminate preirradiation anoxia in the mode of action of the MAO inhibitors, the effect of these compounds after irradiation was tested. It was shown that delaying the administration of the MAO inhibitors until completion of irradiation failed to prevent their characteristic effect on the increased capillary permeability in the intestine; these compounds still caused a 75% reduction of dye leakage. The effect of irradiation on the pressor amine content of the adrenal glands was investigated in rats exposed to half-body irradiation of 1500 r and killed 1, 2 or 3 days later. After irradiation there was a progressive loss of pressor amines (adrenaline and noradrenaline) from the adrenal glands, their lowest concentration being reached 3–4 days after irradiation. Adrenalectomy failed to prevent the action of MAO inhibitors. Injection of the adrenolytic drug dibenamine immediately before administration of the MAO inhibitor HP 1273 and exposure to x rays reversed the usual inhibitory action of HP 1273 on increased capillary permeability. Similarly, simultaneous treatment with dibenamine and HP 1275 caused no inhibition of increased capillary permeability in adrenalectomized rats. Treatment with dibenamine alone failed to affect the usual capillary permeability changes. On the other hand, BOL 148 (1 mg/kg before and a further 1 mg/kg 24 hr after irradiation) failed to modify the effect of the MAO inhibitor in reducing dye leakage assayed 48 hr after injury. In an attempt to reproduce the effect of the MAO inhibitors with the aid of pressor amines, rats were irradiated over the abdomen with 1000 r and then injected immediately with adrenaline (0.5 mg/kg). However, systematically administered adrenaline failed to cause any detectable reduction of vascular permeability in the intestine. Similarly, injections of 5-hydroxytryptamine (5-HT) and noradrenaline led to no significant suppression of dye staining in the intestine as measured 48 hr after irradiation. Pretreatment of rats with pyrogallol, an inhibitor of catechol-O-methyltransferase, an enzyme that inactivates monoamines by a pathway different from that of MAO, failed to diminish the increased capillary permeability 24 or 48 hr after abdominal irradiation with 1000 r. Pretreatment with cysteamine HCl, a radioprotectant SH compound (200 mg/kg immediately before and 100 mg/kg 24 hr after abdominal irradiation with 1000 r), failed to reduce the changes in intestinal vascular permeability assayed 48 hr later. To test the effect of the most successful MAO inhibitor on mortality after x irradiation, rats pretreated with HP 1273 (100 mg/kg subcutaneously) were exposed to 975-r whole-body irradiation. Pretreatment with MAO inhibitors accelerated death after whole-body irradiation. Since the peak mortality coincided with max release of 5-HT from the intestine, the animals may have died from the toxic effects of the released 5-HT rather than from the usual gastrointestinal lesions. This hypothesis is supported by the clinical picture preceding death in the animals pretreated with MAO inhibitors, i.e., a drop in body temperature and profound collapse with moderate gastrointestinal symptoms; the control animals that died in the first few days after irradiation showed the typical syndrome of gastrointestinal death, i.e., bloody diarrhea and the excretion of mucus. (BBB)

33689 EFFECT OF ULTRAVIOLET RADIATION ON GROWTH OF AUTOTROPHIC AND OBLIGATE HETEROTROPHIC CULTURES OF EUGLENA. Richard M. Klein, Maria-Franca Morselli, and Julia Wansor (New York Botanical Garden, New York). J. Protozool., 10: 223-5 (1963).

The growth response to ultraviolet radiation of normal green, streptomycin-, heat-, and ultraviolet-bleached clones of Euglena, grown in light or darkness was examined. In spite of wide variations in constituents of the photosynthetic apparatus present, relative growth suppressions caused by UV were the same among clones grown under identical conditions. Light-grown clones were more sensitive to UV and less sensitive to photorestorative radiation (PR) than comparable dark-grown cultures. From growth rates, sensitivity to UV and PR, and action spectra for PR, it is concluded that components of the photosynthetic apparatus are not involved in those radiation-induced responses affecting growth of Euglena. Independent of their role in photosynthesis, visible radiations play important

and still unknown roles in those processes controlling growth of Euglena. (auth)

33690 EFFECTS OF INTERMITTENT IRRADIATION IN SITU ON RENAL HOMOTRANSPLANTATION. Duane E. Banks, Jr., Richard P. Auburn, Charles A. Hubay, and Lester Persky (Western Reserve Univ., Cleveland). J. Urol., 86: 181-4(Aug. 1961).

Studies were conducted in dogs to test the possible effectiveness of altering both host resistance and graft antigenicity, by irradiating graft site and graft, in prolonging graft rejection. Prolongation of kidney function might in addition be achieved by inhibiting graft vs host response. This could be manifested by a subsequently changed histological picture or by rejection delay. Secondly, the host cells, which are assumed to be the carrier by which antibody reaches the graft, are radiosensitive, and if a time interval exists between their arrival and rejection response, x radiation during this period might prolong survival time. In an effort to test these theories, renal homografts were obtained from donor animals and transplanted to the recipient's neck. Anastomoses were carried out end-to-end between carotid artery of the recipient animals and renal artery of the grafted kidney. The renal vein was anastomosed to the recipient jugular vein. Immediately after surgery, these animals received radiation to the homograft and irradiation daily under anesthesia by a dose of 100 r per treatment. The average total dose received by each of the test animals was ~770 r. The grafts were considered rejected when hematuria, anuria, and/or swelling occurred. The experimental group survived an average of 9.1 days; the control group averaged 9.3 days, the difference being statistically insignificant. Grossly, the kidneys of both groups were similar. Thus, intermittent irradiation did not prolong survival, which suggests that the antibody-carrying cells probably arrive continuously, and need less than 24 hr to initiate the changes leading to rejection. (BBB)

33691 COMPARATIVE STUDY OF INHIBITORY ACTION OF ETHIONINE, 8-AZAGUANINE, 6-MERCAPTOPURINE, AND X OR GAMMA IRRADIATION ON THE INDUCTION OF THE HEPATIC DRUG-METABOLIZING ENZYMES BY PHENOBARBITAL OR PHENAGLYCODOL. Ryuichi Kato, Giuseppe Frontino, and Paulo Vassanelli (Università, Milan). Japan J. Pharmacol., 11: 25-30 (Sept. 1961). (In English)

Enzyme activities, in liver slices, catabolizing phenobarbital and phenaglycodol were measured before and after treatment of rats with the inhibitors or 750-r, whole-body x irradiation or 700- and 1400-r Co^{60} γ irradiation. It was shown that 200 mg kg ethionine, which itself does not modify the enzyme activities, completely abolished the induction of the increased enzyme activity by phenobarbital and phenaglycodol, when it was administered 30 min before injection of the inducing drugs. When ethionine was administered 12 hr after the injection of the inducers, its inhibitory action on the induction was decreased about 50%, and ethionine administered 47 hr after phenobarbital was completely ineffective. Results suggest that ethionine inhibits biosynthesis of the apoenzymes, and does not directly affect enzyme activities. On the other hand, 8-azaguanine only partly inhibited induction of the enzymes by phenobarbital or phenaglycodol. At doses of more than 125 mg/kg, 8-azaguanine manifests a slight depressor effect on activity of the enzymes. 6-Mercaptopurine did not have a significant effect on the induction of the enzymes, and x or γ irradiation did not affect induction of the enzymes. That ethionine inhibited the induction of increase of pentobarbital and phenaglycodol metabolism indicates that the increased drug-metabolizing enzymes induced by the administration of these drugs are brought about through the de novo synthesis of enzyme protein. It is suggested that induction of increase of hepatic microsomal drug-metabolizing enzymes might be accompanied by de novo biosynthesis of microsomal RNA, and that the RNA present in microsome may be sufficient for stimulation by the inducing drugs to carry out the biosynthesis of the apoenzyme. According to an earlier hypothesis, there are 2 types of inducible enzymes, one is 8-azaguanine-sensitive and the other is 8-azaguanine-resistant and the RNA responsible for biosynthesis of 8-azaguinine-sensitive inducing enzyme is of short active life and that of 8-azaguanine-resistant inducing enzyme is of long active life. According to this hypothesis, the RNA responsible for biosynthesis of the inducing hepatic enzymes may be of long life. The difference in the effectiveness between 8-azaguanine and 6-mercaptopurine and radiation is interpreted on the basis of their different actions on RNA biosynthesis. (BBB)

33692 CHANGES IN LUNG PARENCHYMA WITH PREOPERATIVE Co^{60}-IRRADIATION OF BRONCHIAL CARCINOMA. W. Widow (Deutsche Akademie der Wissenschaften, Berlin). Krebsforsch. Krebsbekaempf., 3: 100-4 (1959).

Histologic studies were made of resected lung tissue of 24 patients subjected to radiotherapy. Radiation pneumonitis with incipient fibrosis was observed in 14 cases. In only five of these cases could the histologic findings be confirmed radiologically. The histologic changes included swelling of alveolar septa, interstitial edema, increase of connective tissue components, giant cell formation, exfoliation of alveolar cells, intra-alveolar edema, deposition of cellular debris in small bronchi with apparent injury to the ciliated epithelial and mucous cells, and swelling of the peribronchial and perivascular tissue and pleura. Only a sparse inflammatory cell infiltrate was noted. These responses could not be closely correlated with the radiation dose. The radiation reaction was most marked in the vicinity of old tuberculous lesions. No permanent impairment of pulmonary function would be expected from the observed histologic changes. (H.H.D.)

33693 EFFECTS OF DIAGNOSTIC IRRADIATION. David W. Lindsay (Royal Infirmary, Edinburgh). Lancet, 1: 602-3(Mar. 16, 1963).

A previous report (ibid., 1: 255 (1963)) based on an accumulation of evidence of an association between the incidence of leukemia and exposure to x rays is criticized. This analysis failed to make clear that association is not causation no matter how great the statistical significance of the correlation. References given in this report are cited to show that leukemia is more likely to be due to the disease factors which cause persons to be x rayed rather than due to the x rays themselves. One reference examining the association of other disease with leukemia in adults showed an increase of 173% of respiratory diseases where the x-ray exposure dose in radiological investigation is normally low, but only a 20% increase of gastrointestinal and genitourinary diseases where this dose is normally high. Furthermore, since fetal anoxia, the commonest causes of stillbirths, and conditions giving rise to fetal anoxia are among the commonest indications for antenatal irradiation, these underlying conditions may really be the cause of leukemia. This would explain a close association between x rays and childhood leukemia without implicating x rays as the cause. Other evidence shows fewer cases of leukemia in twins than in single born children, yet twin pregnancies are x-rayed 3 times

more commonly than singletons. Another study revealed only 9 cases of leukemia in diagnostically x-irradiated infants instead of the average expectation of 10.6. Yet, it is suggested, if the results had been the reverse it would only have shown the possibility of x rays being a cause of leukemia. It is concluded that there is no factual proof that diagnostic irradiation of children is leukemogenic. (H.H.D.)

33694 EFFECTS OF DIAGNOSTIC IRRADIATION. David Lindsay (Royal Infirmary, Edinburgh). Lancet, 1: 1003(May 4, 1963).

Evidence of the genetic effects of diagnostic x rays is considered, and it is concluded that the hazards have been overestimated. (TCO)

33695 HARMFUL EFFECTS OF DIAGNOSTIC X RAYS. M. E. Wise (Universiteit, Leiden). Lancet, 1: 1052-3 (May 11, 1963).

The objections of Burch to the previous finding of increased incidence of leukemia in children irradiated in utero, in irradiated adult spondylitics, and in the Oxford survey are answered, and modified conclusions based on the results of these surveys are presented. Burch rejects hypothesis A of the Oxford survey, namely that the excess of myeloid leukemia cases is due to diagnostic x rays to the trunk, in favor of hypothesis B, that most of this excess is due to lower preleukemic fitness of groups receiving trunk x rays in excess. Rather than the modal interval (the one occurring most frequently), Burch in error discusses medians, which are difficult to estimate because there are not enough data on the longer time intervals; in the Oxford survey the modal interval is between 36 and 40 months. From this Burch concluded that in most cases, myeloid leukemia was initiated before the irradiation, on the ground that the true mode was much greater than 50 months, which was Wise's estimate for leukemia induced in spondylitics by therapeutic x rays. The time intervals for the 20 myeloid cases assumed to be induced by therapeutic x rays show 2 modes at 4 and at 7 yr, which for small numbers is in fair agreement with other findings. According to the Oxford survey peripheral therapeutic x rays induce little or no myeloid leukemia and it now looks as if localized irradiation is relatively less dangerous than trunk irradiation. As pointed out earlier, the evidence relating to the subjects who had respiratory diseases in the previous 5 yr strongly supports hypothesis A rather than B. Reanalysis of the spondylitic series on the basis of dose-response relations also confirms the increasing incidence of myeloid leukemia with increasing number of x-ray exposures. (H.H.D.)

33696 SODIUM-22 METABOLISM IN IRRADIATED PATIENTS. F. Di Pietrantonj (Ospedali Galliera, Genoa). Lancet, 2: 460(Sept. 1, 1962).

Turnover of body Na was studied with Na^{22} in patients receiving Co^{60} therapy for cancer. After the administration of 10 to 25 μc of Na^{22} the loss of Na from the body was followed by studying body radioactivity, specific activity of plasma Na, specific activity of urinary Na, and urinary excretion of Na^{22}. The biologic half-life of plasma Na was 15 days. After radiotherapy the urinary excretion of Na^{22} decreased while that of Na^{23} increased. These apparently contradictory results are explained on the assumption that the body Na is not in the ionic state, but is bound to proteins and other substances in plasma and the interstitial compartment. Thus, irradiation diminishes the ability to transform dietary Na into body Na. The organism reacts in two ways to the diminution of its Na stores: the kidney is stimulated to reabsorb more Na, and the intake of Na from the diet is increased. Exogenous Na, however, is not completely utilized, and much is excreted in the urine. (H.H.D.)

33697 HEMATOLOGICAL INDICES FOUND IN X-RAY AND RADIOTHERAPY DEPARTMENTAL STAFF. E. D. Gol'dberg, O. S. Golosov, and K. G. Potekhin. Magy. Radiol., No. 6, 321-6(1962).

The blood of 130 patients exposed to continuous small doses of ionizing radiation by reason of their occupation, and of 75 healthy control subjects not previously exposed to radiation was analyzed. It was found that the staff of x-ray and radiotherapy departments were on the average exposed to a daily dose of 0.02–0.03 r. Some of the subjects complained of occasional headaches, tiredness, and in a few cases skin changes, pigmentations and loss of hair could be observed. In 17% of the exposed persons the white cell count was decreased and in 6.1% it was increased. Among the staff of radiotherapy departments, neutropenia was found in 90.9% of those who worked in these departments for less than 5 years, but only in 75% of those working for more than 5 years. A significant increase in the average size of red cells was found among persons working in radiotherapy departments but not among persons working in x-ray departments. Significant changes were also found in the so-called acid erythrogram. This index represents the graphic recording of the fragility of red cells in serial decreasing dilutions of acid. Histochemical staining of blood films for nucleic acids by the method of Feulgen revealed no significant differences between the exposed subjects and the control group. (OTS)

33698 QUANTUM CHEMICAL EXPLANATION OF THE BIOCHEMICAL EFFECT OF RADIATION. Jånos Barány. Magy. Radiol., No. 6, 360-8(1962).

A theoretical discussion and a new explanation of the biological effects of ionizing radiation is presented. It is stated that to explain the effects, applies a purely physical phenomenon to biological processes such as cell death or mutation of genes, completely disregarding the intervening biological changes. The target theory tries to fill the gaps existing in the biological knowledge with mathematical formulas. A new explanation is proposed for the biological effect of radiation, the quantum chemical theory. According to the quantum theory every chemical transformation takes place in the outermost electronic shell. When an electron is removed from a valency shell forming a covalent bond, this will not only lead to ionization but also to the breakdown of the bond so that the molecule is split into a radical and an ion. These two parts can rapidly combine with other radicals or ions, forming completely new molecules. Attempts were made to show graphically and by schematical illustrations that in the biological environment consisting of multiphase solutions in continuous transformation, the breakdown of a single molecule can lead to the formation of at least 6 different new molecules. (TCO)

33699 CLINICAL USES OF RADIOISOTOPES. Milovan Antic (Military Medical Coll., Belgrad). Med. Glasnik, 17: 98-105(Mar.-Apr. 1963).

The uses of I^{131} in thyroid diagnosis and treatment, Cr^{51} and Fe^{59}, Co^{58}-labeled B^{12} vitamin and I^{131}-tagged serum albumin in hematology are reviewed, also Au^{198} and I^{131}-rose bengal in liver function tests; I^{131}-triolein in exocrine pancreatic studies; I^{131} nephrograms and cardiovascular studies; and distribution, scatter and therapy. (OTS)

33700 OUR RESULTS WITH I^{131} IN THERAPY OF HYPERTHYROIDISM. B. Zimonjic, A. Fajgelj, R. Bokonjic, M. Mutevelic, and A. Musafija (First Internal Medicine Clinic of Medical Faculty and Lab. for Use of Radioiso-

topes, Sarajevo, Yugoslavia). Med. Glasnik, 17: 106-8 (Mar.-Apr. 1963).

The use of radioiodine in 40 patients since 1960 is reported. The results were excellent in 53%, good in 25%, and none in 19%; complicating hypothyroidism in 3%. (TCO)

33701 INTERMEDIATE PHASE OF THYROID CLEARANCE OF I^{131}. Vladimir Bosnjakovic and Petar Milutinovic (Inst. for Medical Research, Belgrad). Med. Glasnik, 17: 112-16(Mar.-Apr. 1963).

Data from 70 patients confirmed that I^{131} clearance is one of the most precise diagnostic methods for differentiating eu- from hyperthyroid conditions. (OTS)

33702 IN VITRO FIXATION OF ERYTHROCYTE TRIIODOTHYRONINE-I^{131} AS AN INDEX OF THE FUNCTIONAL CONDITION OF THE THYROID GLAND. Petar Milutinovic, Sonja Steinfl, Vladimir Bosnjakovic, Olivera Ciric, and Gligorije Novicic (Inst. for Medical Research, Belgrad). Med. Glasnik, 17: 116-20(Mar.-Apr. 1963).

Tests were made on 137 euthyroid (including 97 goitrous) and 122 hyperthyroid patients. Data on 237 patients are given in detail. The test is considered to be a useful complement to currently accessible diagnostic methods. (OTS)

33703 RADIOCARDIOGRAPHY. D. Ivancevic and I. Simonovic (Internal Medicine Clinic of Medical Faculty, Zagreb). Med. Glasnik, 17: 128-31(Mar.-Apr. 1963).

A review on cardiography is presented along with a description of the method using I^{131} serum albumin. (TCO)

33704 RADIOPHOSPHORUS TREATMENT OF CHRONIC LEUKEMIA. Milovan Antic and Bozidar Radojcic (Clinic for Internal Medicine of Military Medical Coll., Belgrad). Med. Glasnik, 17: 132-9(Mar.-Apr. 1963).

Detailed results on the treatment of 15 chronic patients, 9 myeloid and 6 lymphoid, with radiophosphorus are presented. Temporary remissions followed therapy with radiophosphorus in virtually all cases. Although several patients survive in remission now, therapy is considered to be palliative only, effecting no basic change in the course of the disease. (TCO)

33705 OUR EXPERIENCES IN ABSORPTION STUDIES WITH LABELED FATS. Borislav Karanfilski and Penco Davcev (Dept. of Pathological Physiology and Internal Medicine Clinic of Medical Faculty, Skoplje, Yugoslavia). Med. Glasnik, 17: 139-40(Mar.-Apr. 1963).

The use of I^{131} to determine intestinal absorption of fats in 18 patients and 16 controls is presented along with technical details. The method is considered to be a valuable diagnostic aid. (OTS)

33706 DIAGNOSIS OF FOCAL CEREBRAL LESIONS WITH I^{131}. V. Ivacic-Bohacek and I. Simonovic (Medical Faculty of Univ., Zagreb). Med. Glasnik, 17: 141-3(Mar.-Apr. 1963).

Generally very good diagnostic data were obtained in gamma encephalography in 22 patients using I^{131} tagged serum albumin. Two case reports are included. (TCO)

33707 LIVER FUNCTION TESTS WITH RADIOIODINE-TAGGED ROSE BENGAL. M. Antic, S. Tosic, A. Potkonjak, and B. Atanasijevic (Military Medical Coll., Belgrad). Med. Glasnik, 17: 143-6(Mar.-Apr. 1963).

Data on tests in 158 patients including 88 infectious and 14 chronic hepatitis are reported. The Rose Bengal test is technically more convenient than the bromsulphonphthalein retention test and gives essentially the same information. (OTS)

33708 ISOTOPE NEPHROGRAPHY. B. Kastelic (Internal Medicine Clinic of Medical Faculty, Ljubljana, Yugoslavia). Med. Glasnik, 17: 146-50(Mar.-Apr. 1963).

The use of I^{131}-labeled hippurate in retention renal function test is considered excellent to be a diagnostic device. Data obtained in 13 patients are given along with brief comments on the cases. (TCO)

33709 CHANGES OF THE TISSUE CAPACITY OF IRRADIATED ANIMALS TO DESTROY MICROBIAL TOXINS. P. N. Kiselev and V. N. Sivertseva. Med. Radiol., 8: No. 5, 33-9(May 1963). (In Russian)

Attempts were made to study the tissue factors participating in the destruction of endotoxins to which the irradiated organisms become very sensitive. It was disclosed that animal spleen extracts have a marked ability to destroy endotoxins. The process is apparently of enzymatic nature. Rat spleen extract subjected to sublethal x irradiation at the peak of radiation sickness has a two times lesser capacity to destroy the toxic bacterial lipopolysaccharides. Small doses of cortisone activate the mechanisms of endotoxin destruction in the reticuloendothelial system of nonirradiated and irradiated animals. (P.C.H.)

33710 EFFECTS OF IONIZING RADIATION ON STORED BLOOD HEMOGLOBIN. L. S. Bova. Med. Radiol., 8: No. 5, 75-7(May 1963). (In Russian)

Radioinduced inhibition of oxygenation in stored blood hemoglobin is due to the development of inactive hemoglobin derivatives. Physico-chemical and functional changes in irradiated blood depressed hemoglobin resistance to oxidizing factors. Preparation of the stored blood in alcohol-glucose-citrate preservative improved hemoglobin resistance to radiation. (R.V.J.)

33711 DYNAMICS OF LYSINE CHANGES IN GUINEA PIGS EXPOSED TO IONIZING RADIATION. A. G. Goryunova. Med. Radiol., 8: No. 5, 77-9(May 1963). (In Russian)

A sharp drop in lysine content was observed on the second day following the exposure of guinea pigs to 600 r. The lysine depression progressed until the 5th day and was not restored until the animal perished. Sublethal x irradiation also inhibited the content of lysine; however, the lysine standard was restored during the recovery period. (R.V.J.)

33712 DOSE-EFFECT RELATIONSHIPS FOR RADIATION DAMAGE TO ORGANIZED TISSUES. J. F. Fowler (St. Bartholomew's Hospital Medical Coll., London), D. K. Bewley, R. L. Morgan, J. Ann Silvester, Tikvah Alper, and Shirley Hornsey. Nature, 199: 253-5(July 20, 1963).

The relation between dose of ionizing radiation and the survival of mammalian cells is well established. The survival curve has been observed for cells irradiated and cultured in vitro and in vivo. Although some authors assume that the extrapolation number, N, is usually near two for mammalian cells, observations made at the cellular level have demonstrated that higher values of N are frequently observed. The actual value of N for the cells in a given tissue is of great importance, both for theoretical reasons and for the practice of radiotherapy, and this article summarizes evidence from which it may be deduced that the relevant extrapolation number N may often be much greater than two. (H.M.G.)

33713 GENETIC EFFECTS OF STRONTIUM-90 ON IMMATURE GERM-CELLS IN MICE. K. G. Luening, H. Froelén, A. Nelson, and C. Roennbaeck (Research Inst. of National Defence, Sundyberg, Sweden). Nature, 199: 303-4(July 20, 1963).

To determine the effects of Sr^{90} injection on mouse spermatogonia, male mice (strain CBA) were injected with Sr^{90} and mated to virgin females from the 10th up to the 15th week afterwards. Females mated the 10th week were

allowed to give birth to their litters to produce F_1 animals for further tests. Females mated on the 11th to 15th weeks were killed for analysis of lethality among fetuses. It was evident that effects of Sr^{90} on spermatogonia caused an increase in intra-uterine death. From this and previous experiments, it was shown that Sr^{90} injected into male mice causes dominant lethality in all stages of spermatogenesis. The effects of Sr^{90} injected into females was then investigated, and a slightly higher intra-uterine death rate appeared. Effects of dominant lethality on F_2 and following generations were studied. It was indicated that there is no considerable rate of recessive lethals. (H.M.G.)

33714 RADIOSENSITIVE MOLECULAR WEIGHT OF SINGLE-STRANDED VIRUS NUCLEIC ACIDS. William Ginoza (Pennsylvania State Univ., University Park). Nature, 199: 453-6(Aug. 3, 1963).

Samples of X174 virus, X174-DNA, R17 virus, and R17-RNA in tryptone broth were exposed to x and γ radiation under carefully controlled conditions. Inactivation data were used to determine the molecular weights and target sizes of the viruses. The effects of reduced glutathione, oxidized glutathione, sodium phosphate buffer, and pH on results were measured. Results are compared with results from previous studies on the tobacco mosaic virus (TMV) and TMV-RNA. It is concluded that valid radiation target molecular weights for small viruses and their free nucleic acids can be obtained by taking due cognizance of radiation modifying effects of added agents. (C.H.)

33715 SPLITTING OF URACIL DIMER BY HIGH-ENERGY ELECTRONS. B. Schmidt, D. Hartmann, K. Grossgebauer, and W. Schumacher (Freie Universität, Berlin and Städtischen Rudolf-Virchow-Krankenhauses, Berlin). Nature, 199: 504(Aug. 3, 1963).

An aqueous solution of uracil dimer was irradiated with 100 kr electrons of 34 Mev at room temperature. After exposure to β particles, 30% of the radioactivity of the uracil labeled with C^{14} was shown by paper chromatography to be situated in monomer uracil. This high quantity splitting effect was not found after exposure to the same dose of 200-kv x rays, while damages of the monomer molecules rose significantly. Possible implications of the easy splitting of thymine dimer in the restoration of damaged cells are discussed. (C.H.)

33716 EFFECTS OF X-RAYS ON ELECTRICAL ACTIVITY IN THE EYE OF THE COCKROACH BLABERUS GIGANTEUS. W. F. Baldwin, J. B. Sutherland, and J. E. J. Habowsky (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nature, 199: 616(Aug. 10, 1963).

Preliminary results are presented from studies on the effects of x radiation on electroretinograms and the spontaneous electrical discharges in the eye of the cockroach Blaberus giganteus. A marked effect of large doses of radiation on the amplitude and frequency of electrical activity was observed. X radiation also had a marked effect on the response of the eye to light stimulation. (C.H.)

33717 MUTAGENIC ACTION OF SOME RADIOMIMETIC AGENTS ON T2 COLIPHAGE. L. Degen (Recordati Laboratorio Farmacologico, Milan). Pathol. Microbiol., 26: 237-49(1963). (In German)

The mutagenic action of various cytostatic agents used in cancer therapy were assayed by comparing their effect on the mutation rate of $T2h^+$ phage with the spontaneous rate. Myleran increased the rate 10 fold, and a lesser degree of mutagenicity was found with the following drugs (in decreasing order of effectiveness): A139 (2,5-bis-methoxyethoxy-3,6-bis-ethyleneiminobenzoquinone), Mitarson, Endoxan, N-oxide mustard, N-methyl mustard, and N mustard. Their lethal doses in the phage and effect on Escherichia coli B generation time were also determined. The mutagenic action of the N mustards was correlated with the release of chloride ion. Mutagenic action of the agents tested was most pronounced at concentrations $\sim 10^{-5}$M; at higher concentrations cytotoxic effects predominated over mutagenic ones. Demonstration of mutagenic activity of N mustards was carried out in phosphate buffer; it was confirmed that this activity is readily lost in bicarbonate buffer. (H.H.D.)

33718 GENETIC CONTROL OF RADIATION-INDUCED CHROMOSOME EXCHANGE IN RYE. C. W. Lawrence (Wantage Research Lab., Berks, Eng.). Radiation Botany, 3: 89-94(July 1963). (In English)

The number of interchanges detected at meiosis in four inbred lines of rye and their six hybrids after irradiation with 200 rads of Co^{60} γ rays varies considerably between genotypes. The variation appears to depend on variation in induction, and not detection. Several, probably many, genes rise to the variation. They show incomplete dominance and possibly non-allelic interaction. No reciprocal differences were found. The proportions of interchanges appearing as rings or chains of four, or chains of three, chromosomes at metaphase varies between the lines in a manner not directly related to the small differences in metaphase pairing. (auth)

33719 SOME EFFECTS OF X-RAYS ON THE NUCLEUS OF A DINOFLAGELLATE. J. D. Dodge and M. B. E. Godward (Birkbeck Coll., London and Queen Mary Coll., London). Radiation Botany, 3: 99-104(July 1963). (In English)

The first application of x rays to a member of the Dinophyceae, in doses ranging from 50 to 20,000 rads, has shown Prorocentrum micans to be rather less sensitive than cells of higher organisms, but also less resistant than most other algae that have been irradiated. The x rays caused anaphase bridges to appear and, after low doses, these apparently consisted of entire strands. After doses of over 5000 rads the bridges were composed of large numbers of fragments which nevertheless separated to the daughter nuclei. This indicates that the mechanism of mitotic chromosome movement in this organism is unrelated to the presence of a centromere. (auth)

33720 SOME THEORETICAL ASPECTS OF THE SCORING OF MUTATION FREQUENCIES AFTER MUTAGENIC TREATMENT OF BARLEY SEEDS. Ove Frydenberg (Danish Atomic Energy Commission, Research Establishment, Riso, Denmark and Universitet, Copenhagen). Radiation Botany, 3: 135-43(July 1963). (In English)

The various methods of scoring recessive mutants after seed treatment in barley have been discussed recently, and it is shown that certain advantages should be gained by recording the X_2 mutant frequency among all X_2 plants raised in the experiments. Investigating the properties of the X_2-mutant-frequency measure, a mathematical model is presented. When a few well-defined and unavoidable assumptions are accepted, it is demonstrated that the X_2 mutant frequency for all practical purposes is proportional to the initial mutation frequency. The nature of the proportionality factor between the initial mutation frequency and the X_2 mutant frequency is discussed in some details. It is shown that this factor is not always identical with the segregation frequency of the same class of mutants from heterozygous plants. A formula is derived for

estimating the standard deviation of the X_2 mutant frequency by means of an enumeration of the mutant clusters recovered among the X_2 plants. The practical use of this formula is demonstrated by applying it to material obtained after irradiation of dormant barley seeds with two doses of γ rays. (auth)

33721 STUDIES ON A SOMATIC SUBDIVIDED-LEAF MUTANT IN SOLANUM TUBEROSUM. Aage Heiken, Goeran Ewertson, and Lennart Carlstroem (Inst. of Genetics and Plant Breeding, Uppsula and Inst. of Plant Research and Cold Storage, Nynashamn, Sweden). Radiation Botany, 3: 145-53(July 1963). (In English)

The environmental reaction of a somatic subdivided-leaf mutant of the potato variety President was tested in two experiments. It was found that the mutant, besides the abnormal subdivision of leaf, deviates from the normal type by having taller stems and a greater assimilating leaf surface. Significant difference between the two types in yield could not be established. In a seed progeny of the subdivided-leaf mutant after open pollination, 29 out of 49 seedlings showed subdivision of leaf. It was concluded that the mutation that caused the leaf subdivision embraces the subepidermal layer; but the question whether the subdivided-leaf mutant is a monochlamyde or a dichlamyde chimera could not be answered. The anatomic and genetic response of the subdivided-leaf mutant to ionizing radiation was studied in an x-ray experiment. Fifty tuber-halves were treated with a dose of 4,000 r at the advanced stage of germination while the corresponding tuber-halves served as controls. Forty plants of the x-irradiated plants emerged. Five of these plants exhibited from one to three normal shoots. Moreover, in one instance, a few leaves were observed one half of which were subdivided and the other normal. Tubers from 24 vX_1 plants were obtained and planted in the following year. Two plants that had normal shoots in the vX_1 generation produced normal plants in the vX_2 generation; and one plant that had subdivided leaves in the vX_1 generation produced a vX_2 plant bearing three normal shoots and two shoots with subdivided leaves. On the basis of this experiment it was stated that x-ray treatment is an easy and efficient method for disclosing the periclinal structure of somatic mutants in potatoes. In the vX_2 generation, five aberrant types occurred all of which maintained the subdivided-leaf character distinctly in combination with the new induced character. This frequency of induced aberrations is in accordance with those previously recorded in the normal type of the variety. (auth)

33722 ACTION OF X RAYS ON CHARA VULGARIS L. IV: ELONGATION AFTER IRRADIATION OF INTERNODAL CELLS OF 2 CHROMOSOME RACES. C. Gillet (Université, Liège). Radiation Botany, 3: 155-61(July 1963). (In French)

Some doses of x rays stimulate or inhibit more strongly than others the elongation of isolated Chara vulgaris L. internodal cells. Such stimulation can also be found for internodal cells of a telome whose apical cells only were irradiated and in those newly arisen after irradiation. These phenomena are observed after irradiating internodal cells of both chromosome races (n = 14, n = 28) of Chara. The doses producing such phenomena are the same for both races. However, the most efficient dose for the cells of one race is not necessarily the most efficient for the other one. The internodal cells of the 14 chromosome race appear to be more radiosensitive. That difference of cell radiosensitivity at which no mitosis occurs is interpreted as a result of DNA duplication (oriented toward physiological activities) in the euploid race. The stimulation of cell elongation is discussed on the basis of an indirect action of x rays, through the catalase activity, in the IAA-oxidase systems of internodal cells. (auth)

33723 THE RADIOSENSITIVITY OF GYMNOSPERMS. I. THE EFFECT OF DORMANCY ON THE RESPONSE OF PINUS STROBUS SEEDLINGS TO ACUTE GAMMA IRRADIATION. A. H. Sparrow, L. A. Schairer, Rhoda C. Sparrow, and W. F. Campbell (Brookhaven National Lab., Upton, N. Y.). Radiation Botany, 3: 169-73(July 1963). (BNL-6619) (In English)

Seedlings of Pinus strobus (white pine) were exposed for 16.5 hr to Co^{60} γ radiation at dosages from 50 to 1000 r during a period of dormancy or a period of active growth. The effect on growth was determined by measurement of needle lengths. The data show the dormant plants to be considerably more resistant than the actively growing plants. Measurements of interphase nuclear volumes in apical shoot meristems made at various times during the year show a large volume during stages of active growth and much smaller volumes during dormancy. The data strongly suggest that the differences in sensitivity of dormant and actively growing plants may be largely the result of differences in nuclear volumes of these stages. (auth)

33724 INTRODUCTION OF A GAMMA FIELD IN JAPAN. Kiyoshi Kawara (Inst. of Radiation Breeding, Ibaraki-ken, Japan). Radiation Botany, 3: 175-7(July 1963). (In English)

In 1962, a field with a 100-m radius was completed and a Co^{60} γ source of about 2,070 C was installed. Several measures taken for the safety of the general public from injurious radiation are described. Irradiation of plants was begun in April with daily exposures of 20 hr. Plants were planted in the field or brought in pots. (C.H.)

33725 INFLUENCE OF X-IRRADIATION ON ZINC-65 UPTAKE OF TESTES IN MICE. Mikio Shikita and Bun-Ichi Tamaoki (National Inst. of Radiological Sciences, Chiba-shi, Japan). Radiation Res., 19: 419-28(July 1963).

Twenty-four hours after a single whole-body x irradiation (400 r), a significant decrease was observed in Zn^{65} uptake of testes in mice. The decrease was statistically significant in terms of percentages of the injected Zn^{65} per unit weight of either wet or dried tissue. Splenic weight decreased approximately by half, but Zn^{65} concentration in spleen remained unchanged or slightly increased. Zn^{65} uptake of seminal vesicles, kidneys, and submaxillary glands was not influenced by the irradiation. Similar depressant effects of x irradiation on the testicular Zn^{65} uptake was observed after a single local irradiation to scrotum and hind legs (1000 r). Localized irradiation to head and forelegs had less influence on testicular zinc uptake. The fact suggests that the effect was mainly due to a direct effect of the irradiation on the testes. Nineteen days after the localized irradiation to scrotum and hind legs (1000 r), the weight of the testes decreased markedly. Zn^{65} uptake of the damaged testes, however, did not differ from that of the testes in control animals when compared in terms of radioactivity per unit weight of wet or dry organ. The possibility is discussed that the decrease in testicular zinc uptake observed 24 hours after x irradiation is due to a change in the affinity of the interstitial cells to zinc rather than a change in that of germinal cells in the testes. (auth)

33726 EFFECT OF SOME METABOLITES AND ANTIMETABOLITES ON THE BREAKDOWN OF DEOXYRIBONUCLEIC ACID AND ON THE COLONY-FORMING ABILITY OF ESCHERICHIA COLI B AFTER GAMMA IRRADIATION.

I. EFFECT OF CITRATE, GLUTAMATE, SUCCINATE, VERSENE AND MAGNESIUM IONS. M. Drakulić and E. Kos (Institute "Ruder Bošković," Zagreb and Univ. of Zagreb). Radiation Res., 19: 429-38(July 1963).

The effect of a series of metabolites related to the tricarboxylic acid cycle, also of the chelating agent EDTA, and of Mg^{2+} ions, on the γ-irradiation-induced breakdown of DNA and viability of E. coli B was studied. High concentrations of citrate, succinate, and glutamate added to acetate buffer in which the cells have been incubated after irradiation inhibit both the biosynthesis of DNA in the controls and its breakdown in the irradiated cells. These substances have, however, a rather unfavorable action on the colony-forming ability of both the unirradiated and irradiated bacteria, causing their decrease, or even complete suppression. Lower concentrations of succinate and glutamate (10^{-3} M), and the same concentration of EDTA, only partially inhibit the breakdown of DNA in the irradiated cells. The possible meanings of the above results are discussed. (auth)

33727 EFFECT OF SOME METABOLITES AND ANTIMETABOLITES ON THE BREAKDOWN OF DEOXYRIBONUCLEIC ACID AND ON THE COLONY-FORMING ABILITY OF ESCHERICHIA COLI B AFTER GAMMA IRRADIATION. II. EFFECT OF PHOSPHORYLATED DERIVATIVES OF ADENOSINE AND PYROPHOSPHATE. E. Kos and M. Drakulić (Institute "Ruder Bošković," Zagreb and Univ. of Zagreb). Radiation Res., 19: 439-46(July 1963).

A complete inhibition of the biosynthesis of DNA in unirradiated E. coli B as well as a total inhibition of its breakdown in γ-irradiated bacteria was observed if the cells were incubated in acetate buffer in the presence of ATP. In the presence of ADP or of AMP-3′ and AMP-5′, the breakdown of DNA in the irradiated cells is only partially inhibited. If inorganic pyrophosphate is added to the acetate buffer, both the biosynthesis of DNA in the controls and its breakdown in the irradiated suspension are somewhat accelerated. The effects of the above compounds on the colony-forming ability of E. coli B were also studied. The results of these experiments are compared with those obtained in the previous work, and their meaning is discussed. (auth)

33728 RADIATION SENSITIVITY OF MOUSE LYMPH NODE CELLS RELATIVE TO THEIR PROLIFERATIVE CAPACITY IN VIVO. L. H. Smith and O. Vos (National Defence Research Organization, Rijswijk (Z.H.), Netherlands and Oak Ridge National Lab., Tenn.). Radiation Res., 19: 485-91(July 1963).

The 30-day survival of F_1 mice exposed to lethal irradiation (912 r) and injected with parent bone marrow is a function of the number of parent lymph node cells injected. This relationship was used as a calibration curve to determine the surviving proportion of a suspension of lymph node cells irradiated in vitro. The radiation response could be represented by a survival curve, the linear portion of which indicated a D_{37} of 74 r and an extrapolation number of about 2.7. (auth)

33729 X-RAY INDUCED INCORPORATION OF TRITIATED THYMIDINE INTO DEOXYRIBONUCLEIC ACID OF GRASSHOPPER NEUROBLAST CHROMOSOMES. Richard A. McGrath (Univ. of Tennessee, Knoxville). Radiation Res., 19: 526-37(July 1963).

Irradiated Chortophaga neuroblasts at identifiable stages of the cell cycle in the living condition were observed. Changes in chromosome morphology which are characteristic of mitotic stoppage or delay were detected within 15 minutes after 32 r of x rays. Four mitotic responses of irradiated (32 r) prophase neuroblasts can be distinguished: nondelay, delay, stoppage, and reversion. The greatest number of types of response is seen in cells which were irradiated in late prophase, whereas the least variety of responses occurs after treatment of very early prophases. Preparations given 250 r of X-rays show reversion of prophase cells to an interphase-like condition. The observation of living neuroblasts exposed to tritiated thymidine (H^3T) and then irradiated in hanging-drop preparations and reidentification of the same cells in autoradiograms of sectioned material show that: prophase neuroblasts which are delayed, stopped, or reverted mitotically in response to 32 r of X-rays incorporate H^3T, incorporation is greater in cells irradiated in early prophase and less in cells treated in middle or late prophase, and no incorporation is seen in cells treated in very late prophase, incorporation is not seen in preparations treated with DNase before application of autoradiographic emulsion, labeling can be detected within 15 minutes after x irradiation of early or middle prophase neuroblasts, and after 250 r of x rays, prophase cells which do not divide within about 40 minutes do incorporate H^3T during reversion to an interphase-like condition. (auth)

33730 EFFECTS OF X-IRRADIATION ON CELL DIFFERENTIATION AND MORPHOGENESIS IN A DEVELOPING BEETLE WING. James S. Beck (Univ. of California, Berkeley). Radiation Res., 19: 569-81(Aug. 1963).

X irradiation of the flour beetle, Tribolium confusum, during the first day of the pupal stage produced a gross deformity of the wings of the adult. The characteristics of this deformity were studied microscopically and by determination of the P^{32} content after neutron exposure. Data are presented on the effects of various radiation doses on cell differentiation and morphogenesis in the developing beetle wing. (C.H.)

33731 EFFECTS OF CERTAIN METAL SALTS ON THE INACTIVATION OF SOLID TRYPSIN BY IONIZING RADIATION. J. A. V. Butler and A. B. Robins (Chester Beatty Research Inst., London). Radiation Res., 19: 582-92(Aug. 1963).

Copper and Fe sulfates, present in solid trypsin, increased the radiation inactivation dose considerably; but Co, thallous, and cerous sulfates were ineffective. Zinc sulfate had a small protective action. Copper and Fe sulfates formed complexes with trypsin which were detected by their optical absorption, and the maximum complex formation occurred at about the concentration which gave the maximum protective effect. Cobalt sulfate did not form a complex detectable in this way. The effect of O on the samples containing Cu and Fe was somewhat less than on the original trypsin; with the other metal salts, the effect of O was the same as on trypsin alone. There appear to be two types of protective action, in which the effect of oxygen is not greatly different from its effect when the agent is absent (metal ions), and the effect of oxygen is enhanced by the protective agent (e.g., cysteine). Mechanisms of these processes are discussed. (auth)

33732 THE RADIATION-SENSITIZING EFFECTS OF N-ETHYLMALEIMIDE AND IODOACETIC ACID ON A RADIATION-RESISTANT MICROCOCCUS. J. S. Lee, A. W. Anderson, and P. R. Elliker (Oregon State Univ., Corvallis). Radiation Res., 19: 593-8(Aug. 1963).

The sulfhydryl group combining agents, N-ethylmaleimide (NEM) and iodoacetic acid (IAA), were investigated for their abilities to enhance γ-radiation inactivation of Micrococcus

radiodurans. At the nontoxic level of 100 μM, the inactivation by irradiation was accelerated with IAA, but no effect was observed with NEM. The removal of O did not produce any detectable changes in the action of either chemical. The accelerated radiolethal effect appears to be due to the highly reactive radiolytic products of IAA and their nonspecific reactions with various cellular constituents. (auth)

33733 ASSESSMENT OF ACTINOMYCIN AND RADIATION DAMAGE OF STEM CELLS BY ERYTHROPOIETIN TOLERANCE TEST. Clifford W. Gurney and Diana Hofstra (Argonne Cancer Research Hospital, Chicago and Univ. of Chicago). Radiation Res., 19: 599-605(Aug. 1963).

A technique for the measurement of the combined effect of x irradiation and actinomycin D on the responsiveness of stem cells to erythropoietin is reported. Findings indicate that, when irradiation was administered to mice immediately after actinomycin injection, deleterious effects on the stem cell, as measured by the erythropoietin tolerance test, were additive. Approximately 87 μg of actinomycin per kg produced the same impairment of response to a standard dose of erythropoietin as does 150 r of total-body irradiation. Although the response to a standard dose of erythropoietin in the hypertransfused animal was normal 4 and 5 days after administration of the 87 μg of actinomycin D per kg, residual damage in such animals could be detected when the challenging dose of erythropoietin was delayed until the sixth day. (auth)

33734 EFFECT OF PRETREATMENT WITH COLCHICINE OR A COLCHICINE DERIVATIVE ON HEMOPOIESIS IN IRRADIATED MICE. Willie W. Smith, Ilo M. Alderman, Carol A. Schneider, and Jerome Cornfield (National Cancer Inst., Bethesda, Md. and National Heart Inst., Bethesda, Md.). Radiation Res., 19: 621-7(Aug. 1963).

Treatment of mice with colchicine or trimethylcolchicine acid methyl ether prior to irradiation caused an increase in bone marrow cellularity which was apparent 3 days after LD_5 irradiation; no significant increase in granulocyte counts 3 to 4 days after irradiation; a relatively small but significant increase in lymphocyte counts 3 to 4 days after irradiation; an advance in the time of recovery of granulocyte counts consistent with the effect on survival, which was equivalent to a mean dose-reduction of 180 rads; and a similar advance in the time of recovery of lymphocyte counts. (auth)

33735 THE GENERATION CYCLE OF DUODENAL CRYPT CELLS OF MICE EXPOSED TO 220 ROENTGENS OF COBALT-60 GAMMA IRRADIATION PER DAY. R. J. M. Fry, S. Lesher, A. Salles, and E. Staffeldt (Trinity Coll., Dublin and Argonne National Lab., Ill.) Radiation Res., 19: 628-35(Aug. 1963). (TID-17602; UAC-6973).

The mucosal epithelium of the duodenum of BCF_1 mice exposed to 220 r/day for 1, 7, 14, 17, and 18 days was studied and compared to that of nonirradiated controls of the same age. The generation time of the duodenal crypt cells of mice irradiated for 1, 7, and 14 days, and of the controls, was determined. Since it was found that cells are held up between the end of synthesis and the completion of mitosis, the initial effect may be similar to the effect produced by a single exposure. When exposure is continued, there is an attempt to compensate for cell loss by a speeding up of the generation cycle which is primarily due to a reduction of G_1. (auth)

33736 EFFECT OF PARTIAL HEPATECTOMY ON NUCLEIC ACID METABOLISM OF REGENERATING THYMUS. A. O. Smoot and J. L. Van Lancker (Univ. of Utah, Salt Lake City). Radiation Res., 19: 659-69(Aug. 1963).

The incorporation of orotic acid-C^{14} was investigated in C57BL mouse thymus DNA and RNA after local irradiation with 300 r, and in liver regenerating after partial hepatectomy. The effect of DNA synthesis in regenerating liver on DNA synthesis in regenerating thymus was further investigated by arranging the time sequence of the irradiation of the thymus and of the partial hepatectomy so as to make maximum DNA synthesis in liver coincide with maximum DNA synthesis in thymus. It was observed that, under these conditions, the incorporation of the precursor into the irradiated thymus was reduced 40%, suggesting a competition between liver and thymus for factors necessary for regeneration. (auth)

33737 EFFECT OF X-RADIATION ON DNA METABOLISM IN VARIOUS TISSUES OF THE RAT. V. DNA METABOLISM IN GENERATING THYMUS. Yukio Sugino Eugene P. Frenkel, and Richard L. Potter (Univ. of Michigan, Ann Arbor and Univ. of Texas, Dallas). Radiation Res., 19: 682-700(Aug. 1963).

The effect of sublethal total-body x irradiation on DNA synthesis was studied in the thymus of the rat. The rate of pyrimidine nucleoside precursor incorporation was followed during the postirradiation period and correlated with the related enzymes and with the morphologic events during this period. The postirradiation period can be divided into a period of radiation reaction followed by a period of tissue regeneration. During the period of radiation reaction, markedly decreased precursor incorporation is noted as well as a decrease in the related enzymes (dCMP deaminase and thymidylate synthetase). The period of regeneration appears to consist in two discrete phases. The first phase (days $2\frac{1}{2}$ to $3\frac{1}{2}$) reveals a return of the dCMP–dUMP–TMP enzymes and a markedly increased rate of labeled thymidine or radiophosphorus incorporation. During this phase a change in the ratio of DNA-T to DNA-C is present. The second phase (days 4 to 5) is highlighted by a markedly increased rate of labeled deoxycytidine incorporation. Adequacy of dCMP deaminase and thymidylate synthetase and the endogenous pool size of TMP appear to be crucial factors in this dual-phased recovery period of postirradiation injury. (auth)

33738 EFFECT OF X-RADIATION ON DNA METABOLISM IN VARIOUS TISSUES OF THE RAT. VI. CORRELATIVE MORPHOLOGIC AND BIOCHEMICAL CHANGES DURING THE REGENERATION OF THE THYMUS. Eugene P. Frenkel, Yukio Sugino, Ronald C. Bishop, and Richard L. Potter (Univ. of Michigan, Ann Arbor and Univ. of Texas, Dallas). Radiation Res., 19: 701-16(Aug. 1963).

Correlative morphologic observations by means of routine cytologic and autoradiographic techniques were made in the thymus of the rat after sublethal total-body x irradiation. As with the biochemical observations, a period of radiation reaction can be differentiated from the period of tissue regeneration. A sequential pattern of morphologic and synthetic (incorporation of labeled precursors of DNA) events was demonstrated. These occurred first in the reticulum cells, then in the monocytoid reticular lymphoblasts, and finally in an emerging population of young lymphocytes. The studies suggest that the primitive reticulum cells reproduce with the available preformed Tdr (from the injured lymphocytes) and that these cells probably contain Tdr kinase but lack dCMP deaminase and TMP synthetase. The breakdown or death of lymphocytes may provide the Tdr to the reticulum cell which is capable of phagocytosis,

and thus serve as the tirgger to synthesis of protein in the reticulum cell and then replication of that cell. It is postulated that the monocytoid lymphoblasts are capable of de novo synthesis and thus contain dCMP deaminase and TMP synthetase. Finally, mature lymphocytes may demonstrate little or no synthesis because of lack of a rate-limiting enzyme such as TMP kinase or DNA-primer formation. (auth)

33739 BEHAVIOR OF SIALIC ACID IN THE BLOOD OF WHOLE-BODY IRRADIATED RABBITS. G. Sanna (Ospedale Civile, Cesena, Italy). Radiobiol. Radioterap. Fis. Med., 17: 479-86(Nov.-Dec. 1962). (In Italian)

The nature and properties of sialic acid, for which studies were recently made in the field of serum glycoprotein physiopathology, are discussed. It is shown that this substance undergoes a remarkable increase in the blood of the whole-body irradiated rabbit. This is probably caused by the radio-depolymerization of fundamental material. (tr-auth)

33740 DISTRIBUTION OF P^{32} AFTER WHOLE-BODY IRRADIATION. Z. Dienstbier and F. Vítek (Charles Univ., Prague). Radiobiol. Radiotherap., 4: 129-37(1963). (In English)

The incorporation of $Na_2HP^{32}O_4$ in the brain, muscles, bones, lungs, kidney, liver, testes, intestines, spleen, thymus, and the bone-marrow was investigated in non-irradiated rats as well as in rats irradiated with a dose of 600 r. The level of P^{32} in the blood was also followed. The dynamics of the incorporation of the radioactive phosphorus was studied 24 hours, 3, 7, and 14 days after irradiation. A lower incorporation of P^{32} in the radiosensitive organs of irradiated rats was observed that is statistically significant. The activity of P^{32} is greater in the blood the first day after irradiation than in non-irradiated animals. A higher incorporation of the radioactive phosphorus was found in the bones of the irradiated rats. The results are discussed. (auth)

33741 THE SIGNIFICANCE OF THE ALTERED SEROTONIN METABOLISM FOR THE GENESIS OF RADIATION CONDITIONED HAEMORRHAGE. G. A. Černov (Central Inst. for Hematology and Blood Transfusion, USSR). Radiobiol. Radiotherap., 4: 139-53(1963). (In German)

Monkeys, dogs, guinea-pigs, rats, and mice showed a direct dependence between the pronounced symptoms of the hemorrhagic syndrome and the degree of the disturbance of serotonin metabolism in the organism with the acute radiation sickness. With the acute form of the disease there was seen a strong decline of the serotonin level in the blood temporarily combined with the clinical appearance of the hemorrhagic syndrome; with the mild course of radiation sickness of these changes were less pronounced. It was shown that in the acute stage of the disease a decline of the activity of the extracerebral 5-OTD (5-oxytrypto-decarboxylase) as well as a decline of the serotonin content occurred in the intestine, whereas the serotonin level in the brain and the activity of the cerebral 5-OTD showed no significant changes under the same conditions. Data are included on the changes of the MAO-activity (Monoaminooxydase) in the intestine, brain, and liver, during acute radiation sickness. (auth)

33742 THE INFLUENCE OF OXYTETRACYCLINE, VITAMIN B_{12}, AND FOLIC ACID ON THE CHANGES OF BLOOD PLASMA PROTEINS AFTER IRRADIATION. P. Mach and J. Surynek (Inst. of Veterinary Research, Brno). Radiobiol. Radiotherap., 4: 155-7(1963). (In English)

Oxytetracycline, together with vitamin B_{12} and folic acid was found to exert a serious inhibitory effect on gamma-globulin content of blood plasma in the irradiated, as well as in the nonirradiated, organism. (auth)

33743 EFFECT OF CONTACT OF ROENTGEN-IRRADIATED SALAMANDER EMBRYOS ON NON IRRADIATED SALAMANDERS. G. Scheitanov and G. Russev (Höheren Militär-Medizinischen Institut, Sofia). Radiobiol. Radiotherap., 4: 159-65(1963). (In German)

About 2800 embryos of Triturus cristatus were examined. It was established that embryos irradiated with larger roentgen doses (3000 to 12,000 r) have a toxic effect on non-irradiated neighboring embryos. The toxidity is directly proportional to the dose. The effect of small doses (30 r) and a small number with 6000 r irradiated embryos, has a stimulating character. Here it is the matter of a chemical factor that can be washed out or destroyed by boiling it for several minutes. (auth)

33744 THE REACTIONS AT BLADDER AND INTESTINE WITH THE IRRADIATION OF CARCINOMA OF THE UTERINE CERVIX. D. Buttenberg (Universität-Frauenklinik, Heidelberg). Radiobiol. Radiotherap., 4: 185-94(1963). (In German)

Injuries to the bladder and small intestine resulting from therapeutic irradiation of carcinoma of the cervix are described. An early reaction in the mucous membrane of the neighboring organs was observed in about one-fourth of the cases observed. The danger of radioinduced fistula formation and late radiation effects on bladder function is discussed. (C.H.)

33745 MULTIPLE CARCINOMATOUS GROWTHS AND SKIN SARCOMA IN A PATIENT WITH CHRONIC ROENTGEN-RAY DERMATOSIS. A. Kúta (Charles Univ., Prague). Radiobiol. Radiotherap., 4: 231-40(1963). (In English)

A case of an extensive chronic roentgen-ray dermatosis on the face of a 68 year old man is reported which developed approximately thirty years after x-ray treatment for sycosis barbae and eczema on the hands. Both fore-arms were amputated six and fourteen years after radiation therapy because of severe destructive lesions. Within the area of this late chronic roentgen-ray dermatosis on the face (forehead, nose, eyelids) gradually eight malignant tumors developed, i.e., four spinocellulars carcinomas, three basal-cell carcinomas, and one polymorphocellular sarcoma. All of the tumors, including polymorphocellulars sarcoma, were sparingly excised with optimum therapeutic and cosmetic results and the patie. t has now for more than two years shown no signs of relapse. There is only an atypic flat spinocellular lesion on the right ala nasi which is uncertain. (auth)

33746 A CONTEMPORARY PROBLEM — CONGENITAL ANOMALIES. L. Copelman and L. Grollet. Rev. Pathol. Gen. Physiol. Clin., 61: 1045-7(Oct. 1961). (In French)

The role of ionizing radiations and other agents in teratogenesis is briefly reviewed. (H.H.D.)

33747 MUTATIONS: INCIDENCE IN DROSOPHILA MELANOGASTER REARED ON IRRADIATED MEDIUM. M. S. Swaminathan, Satya Nirula, A. T. Natarajan, and R. P. Sharma (Indian Agricultural Research Inst., New Delhi). Science, 141: 637-8(Aug. 16, 1963).

An increase in the rate of mutation was found in Drosophila melanogaster reared on a basic medium that was irradiated with a sterilizing dose (150,000 rads) of Co^{60} γ

rays. In Muller-5 tests, sex-linked recessive lethals occurred only in the F_2 progenies of the male test flies obtained from breeding the parent flies on irradiated medium, while visible changes occurred in experimental cultures from both the control and irradiated media. The frequency of sex-linked recessive lethals was 0.35, 0.55, and 0.8% in three independent experiments. Visible changes were two to six times more frequent in the irradiated series than in the controls. (auth)

33748 BIOLOGICAL MECHANISMS UNDERLYING THE AGING PROCESS. Howard J. Curtis (Brookhaven National Lab., Upton, N. Y.). Science, 141: 686-94(Aug. 23, 1963). (BNL-6933)

Several theories put forward to explain the biological mechanisms underlying the aging process are examined. The only ones which attack the problem from the point of view of basic biological mechanisms are the wear-and-tear theory and the somatic mutation theory. The finding that radiation accelerates the aging process is a potent tool for attacking the problem experimentally. Experiments with mice specifically designed to verify the wear-and-tear theory showed conclusively that stress per se does not contribute to aging, and no experimental evidence could be found to support the theory. On the other hand, a great deal of evidence now available indicates that mutations in somatic cells play a dominant role in aging. It is further shown that the organs having cells which frequently undergo cell division take part in the aging process very little, if at all. Organs having cells which seldom, if ever, divide have no opportunity to throw off either spontaneous or induced mutations, and it is these organs which are responsible for the aging of the animal. Spontaneous mutations build up at a rapid rate in these organs. A cell may continue to function normally long after it has suffered a deleterious mutation, and this accounts for much of the delay in the expression of radiation damage. It is suggested that the mutation rates for somatic cells are very much higher than the rates for gametic cells, and that this circumstance insures the death of the individual and the survival of the species. (auth)

33749 DISSOCIATION OF HOMOGRAFT RESPONSE TO ALLOGENEIC VERSUS XENOGENEIC SKIN GRAFTS IN IRRADIATED MICE. Marvin L. Tyan and Leonard J. Cole (Naval Radiological Defense Lab., San Francisco). Science, 141: 813-14(Aug. 30, 1963).

Lethally x-irradiated (C3H × DBA/2)F_1 mice were protected with syngeneic (isogenic) bone marrow and/or prior treatment with urethan and skin grafted at various times after irradiation. The ability to reject a first-set xenogeneic (heterologous) skin graft with normal vigor returned within 92 days; the first-set response to allogeneic (homologous) grafts was still impaired 350 days after irradiation. (auth)

33750 HODGKIN'S DISEASE FOLLOWING ADMINISTRATION OF THOROTRAST. John V. Verner, Jr., and Albert G. Smith (Duke Univ., Durham, N. C.). Southern Med. J., 56: 524-8(May 1963).

A case of Hodgkin's disease developing 12 yr following administration of ThO_2 is reported, representing the only known example of this disease associated with Th. Radiography of the abdomen showed increased density of the liver and spleen, as well as radiopaque densities in the abdomen presumably representing nodes which were heavily infiltrated with ThO_2. The densities in the liver and spleen were also ascribable to ThO_2 deposits. The tumor consisted of pleomorphic round and polyhedral cells and Reed-Sternberg cells, along with areas of fibrosis, necrosis, hemorrhage, and mononuclear cell reaction. Pleomorphic cellular changes were frequently found adjacent to deposits of ThO_2. ThO_2 was also found throughout the reticuloendothelial system, as in the reticulum cells of the liver, spleen, and lymph nodes. Using a gas-flow counter, significant counts of radiation were detected in the spleen and periaortic lymphoid tissues, sites histologically demonstrated to contain Th and tumor. Proliferated bile ducts in hepatic portal areas were of interest because of reported bile duct carcinoma of the liver in patients previously receiving Thorotrast. The presence of tumor cells in the reticuloendothelial system surrounding granules of ThO_2 suggests that Th induced or initiated the development of Hodgkin's disease with spread to the kidneys and other organs containing little or no Th. A table is given listing anatomic sites where tumors associated with Thorotrast have been found in the commonly recognized types of tumors in rough order of incidence. It is suggested that there is ample evidence to incriminate Thorotrast as a definite oncogenic agent. (H.H.D.)

33751 RADIOSENSITIVITY OF CERVICAL CANCER. James A. Merrill (Univ. of Oklahoma, Oklahoma City). Surg. Clin. North Am., 42: 985-1004(Aug. 1962).

Methods for evaluating radiosensitivity of cervical carcinoma are described and experience in their application reported. Attempts made to predict biologic malignancy and degree of radiosensitivity from examination of pretreatment cervical biopsies showed that there is some correlation between histologic differentiation and malignancy of squamous carcinoma of the cervix. However, the available data are not sufficiently clear to establish correlation between histologic grade and either radiocurability or radiosensitivity. Histologic grading of cervical biopsies is of little or no value in predicting the prognosis of a patient with carcinoma of the cervix treated radiologically. A previously reported correlation between the chromosomal population of cervical squamous carcinoma cells and radiosensitivity offers a new avenue of investigation which can be accomplished in the pretreatment stage. In most cases there was a correlation between higher ploidy (more than 60 chromosomes) of malignant cells and their radioresistant character, and between lower ploidy (less than 60 chromosomes) and radiosensitive behavior. Cervical biopsies obtained during the course of radiation therapy were examined in an attempt to correlate the histologic changes with the ultimate effect of radiation on the tumor and the survival of the patient. The presence or absence of tumor cells in vaginal smears during the month immediately following completion of radiation therapy was correlated with clinical outcome in 108 cases followed 2-4½ yr. A cytological radiation response (RR) is more frequent in postmenopausal than in premenopausal women and increases with advancing age and supervoltage radiation. Gross characteristics of the tumor, stage of the lesion, and general health of the patient had no significant effect upon the frequency of or degree of RR. These data suggest that the cytological method of predicting RR is of limited value in those cases of very early or late cancer, the RR frequently being the converse of the expected and actual clinical outcome. The histological prognosis correlates well with the clinical outcome and is, generally, more reliable than cytological studies. Results of cytochemical technique were essentially the same as those with the histological technique. The evaluation of biopsy specimens by the cytochemical method was, however, more difficult than with either of the other two techniques. The value of

histological and cytochemical techniques combined appears greater than either technique alone, especially in predicting an unfavorable response. (TCO)

33752 ORGAN TRANSPLANTS IN DOGS AFTER CROSS-CIRCULATION, CHEMOTHERAPY, AND RADIATION. H. B. Hechtman, D. A. Blumenstock, E. D. Thomas, and J. W. Ferrebee (Mary Imogene Bassett Hospital, Cooperstown, N. Y.). Surgery, 52: 810-18(Nov. 1962).

Attempts were made to improve the tolerance of dogs to homografts. Immunologic responsiveness of recipients was weakened by chemotherapy or radiation, and a considerable overloading with donor cellular antigen was attempted by repeated cross-circulation. Forty-four dogs were paired and subjected to two cross-circulations of 30 to 50 liters each at an interval of four weeks. The dogs were subdivided into five groups according to the treatment with antimetabolite or sublethal radiation given subject and partner. Dogs given antimetabolite (methotrexate or BW-57-322), in dosage known to inhibit immune response, frequently died of emaciation, infection, leukopenia, and thrombocytopenia if they had cross-circulation with a normal partner. Deaths did not occur when the immunologic responsiveness of the partner was weakened by radiation and chemotherapy. It is suggested that they were caused by the reactions of the immunologically competent cells contained in the blood of untreated partners. Drug toxicity per se did not appear to be the basis for the syndrome observed, since dogs not subjected to cross-circulation which received higher doses of methotrexate developed no wasting syndrome, and no leukopenia or thrombocytopenia. Cross-circulation did not improve survival of subsequent organ grafts from the cross-circulation partner. Prolongation of graft survival observed occasionally when drug or radiation therapy was also seen in animals treated with methotrexate alone. The lack of general success with cross-circulation, radiation, and chemotherapy illustrates the limitation of procedures intended to induce tolerance to organ grafts in adult dogs. (TCO)

33753 SENSITIVITY OF TWO STRAINS OF COCOA PLANTS TO GAMMA RADIATION. Fernando Monge (Instituto Interamericano de Ciencias Agricolas, Turrialba, Costa Rica). Turrialba, 12: 91-3(Apr.-June 1962). (In Spanish)

Two strains of cacao, Matina and UF 613, were found to differ in their response to acute gamma irradiation of seeds, Matina being more sensitive than UF 613. This was based on survival and hypocotyl height of the surviving population. Cytological examination of root-tip cells revealed that sensitivity was related to nuclear damage. Trials were made to test the effect of the reduction of oxygen concentration, which lowers metabolic activity, on radiosensitivity between the two cacao strains. The curves obtained by plotting hypocotyl height against dose show that the reduction of oxygen concentration exerts a protective action on both lines. Nevertheless, the difference in sensitivity between Matina and UF 613 still exists. (auth)

33754 PRELIMINARY STUDIES ON LATE SOMATIC EFFECTS OF RADIOMIMETRIC CHEMICALS. A. C. Upton, J. W. Conklin, T. P. McDonald, and K. W. Christenberry (Oak Ridge National Lab., Tenn.). p.171-5 of "Cellular Basis and Aetiology of Late Somatic Effects of Ionizing Radiation." London and New York, Academic Press, 1962.

The life-span of mice surviving mid-lethal doses of nitrogen mustard (HN2), triethylene melamine (TEM), and X rays was reduced. The extent of life shortening was greatest in the irradiated mice, intermediate in the TEM-treated animals, and smallest in those given HN2. The decrease in longevity was not ascribable to any single lesion or group of lesions but was associated with premature onset of diseases of senescence. Moreover, mice without neoplasms died as early as those with neoplasms. All three agents increased the incidence of certain neoplastic growths, but the oncogenic effects varied from one organ to another, no two agents affecting all organs similarly. Lens opacities were induced by each agent. However, those in the HN2-injected mice were barely distinguishable from spontaneously occurring senile cataracts. (auth)

33755 THE CELLULAR BASIS AND AETIOLOGY OF THE LATE EFFECTS OF IRRADIATION ON FERTILITY IN FEMALE MICE. W. L. Russell and E. F. Oakberg (Oak Ridge National Lab., Tenn.). p.229-32 of "Cellular Basis and Aetiology of Late Somatic Effects of Ionizing Radiation." London and New York, Academic Press, 1962.

The degree of irradiation-induced shortening of the reproductive life-span in female mice varies with dose-rate, age of female, and other factors. The basic pattern of this response is accounted for by the amounts of killing in the pool of oocytes in immature follicle stages. Thus, an effect on fertility, which, at low doses or low dose-rates, is long-delayed in appearance, is traced back to cell deaths occurring within 24 hours after irradiation. (auth)

33756 AGE-SPECIFIC DEATH RATES OF MICE EXPOSED TO IONIZING RADIATION AND RADIOMIMETIC AGENTS. A. C. Upton, M. A. Kastenbaum, and J. W. Conklin (Oak Ridge National Lab., Tenn.). p.285-97 of "Cellular Basis and Aetiology of Late Somatic Effects of Ionizing Radiation." London and New York, Academic Press, 1962.

The life-shortening action of ionizing radiation in the mouse is well documented (Mole, 1957; Neary, 1960; Upton, 1960). In this animal, moreover, irradiation early in life causes a displacement of the Gompertz curve, which some observers say may indicate induction of precocious senescence. As yet, however, there is relatively little detailed information on the age-specific incidence of various diseases in the mouse, their relation to senescence, and how their development is affected by radiation. This report presents preliminary results from a study of age-specific death rates of mice irradiated in earlier experiments. (auth)

Radiation Sickness

33757 (BNL-7145) EFFECT OF ACUTE FALLOUT RADIATION ON A MARSHALL ISLAND POPULATION. R. A. Conard (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract AT-30-2-GEN-16. 33p. (CONF-150-1)

From Congress of Science on Humans, 2nd Annual Conference, New York, June 1963.

The acute and residual effects of a localized fallout exposure on the people of Rongelap Island are summarized for the 8-yr period subsequent to their accidental exposure on March 1, 1954. The accident occurred following the detonation of a high-yield nuclear device at the Pacific Proving Grounds. Twenty-three Japanese fishermen aboard the Lucky Dragon were also exposed. The 64 inhabitants of the island, located 105 nautical miles from the detonation, received an estimated dose of 175 r of whole-body γ radiation, contamination of the skin sufficient to result in β burns, and slight internal absorption of radioactive ma-

terials through inhalation and ingestion. The fallout resembled a light snowfall. The exposed people were evacuated about 2 days after the accident and received extensive examinations for the following 3 mo. Annual medical surveys have revealed only minimal residual effects in the exposed population. (C.H.)

33758 QUANTITATIVE STUDIES CONCERNING THE RADIATION PROTECTIVE EFFECT OF CELL-FREE MOUSE AND GUINEA PIG SPLEEN EXTRACTS. Friedrich Ellinger and B. F. Lindsley (Naval Medical Research Inst., Bethesda, Md.). Arch. Intern. Pharmacodyn., 132: 310-16 (1961).

Cell-free saline extracts of lyophilized spleen were injected in sublethally and lethally irradiated animals. Mouse spleen extract protects both mice and guinea pigs and vice versa. This suggests a common factor as the protective principle of these extracts; but, the protective effect is not parallel with the total protein content. Though mouse spleen extracts showed 50% less total protein content than guinea pig spleen extracts, they effectively reduced mortality of guinea pigs at various radiation doses. A spleen equivalent of 346 to 505 mg of frozen wet wt per injection was protective. In contrast, the spleen equivalent of guinea pig extracts necessary for the protection of both species varied between 970 and 1870 mg per injection. Thus, the guinea pig spleen which is 4 to 5 times heavier than mouse spleen contains less protective factor per unit wt. There seems to exist a threshold value for the spleen equivalent for each species of donor animals below which a reduction of radiation mortality cannot be effected. The irradiation mortality rate influences the amount of spleen equivalent to extracts necessary for protection. Preliminary paper chromatographic studies of extracts point to the significance of relative proportions of amino acids. Hence, free amino acids may represent the effective principle in these extracts, but other chemical entities also must be considered. (TCO)

33759 A COMPARATIVE EVALUATION OF THE EFFECTIVENESS OF THE RADIOPROTECTIVE PROPERTIES OF MERKAMINE (BETA-MERCAPTOETHYLAMINE) WITH A SINGLE DOSE AND WITH A FRACTIONATED DOSE SPREAD OUT OVER A PERIOD OF TIME. S. N. Aleksandrov and K. F. Galkovskaya (Central Research Inst. of Medicinal Radiology, USSR). Dokl. Akad. Nauk SSSR, 150: 665-7(May 21, 1963). (In Russian)

White mice were subjected to a single Co^{60} dose of 800 r, and to 4 separate doses of 200 r each, given at intervals of 7 days. The mice were given a dosage of 0.15 mg/g of an aqueous solution of the merkamine salt before each irradiation. The use of merkamine improved the survival at 30 days by a factor of two as compared to the controls for a single dose of 800 r, but has no effect on the survival with four doses of 200 r each. It was also established that the introduction of merkamine did not increase the life span of the mice surviving the acute radiation syndrome. (TTT)

33760 EXTERNAL PANCREATIC SECRETION IN RESPONSE TO HUMORAL STIMULI IN ACUTE RADIATION SICKNESS. E. K. Kuznetsova (Kirov Military Medical Academy, USSR). Med. Radiol., 8: No. 5, 23-9(May 1963). (In Russian)

It is shown that in dogs with acute radiation sickness, humoral stimuli disturb the external secretory function of the pancreas. Secretory disorders are associated with this stage of the disease. At the peak of the disease humoral stimulation of the pancreas is minimal. Disturbances of the pancreatic secretion are due to some extent to disorder of secretin formation in the small intestine. (auth)

33761 PROPHYLACTIC AND THERAPEUTIC EFFECTS OF THE SYNERGISTIC ACTION OF EFFECTIVE SUBSTANCES ON RADIATION SICKNESS IN ANIMALS. A. M. Stashkov and V. P. Korotkova. Med. Radiol., 8: No. 5, 79-82(May 1963). (In Russian)

Effects of various combinations of cystamine, purine, and pyrimidine compounds, pyridoxin (vitamin B_6), and narcotic drugs on radiation sickness in animals were studied for 30 days in white mice (male) weighing 18 to 20 g. The animals were subjected to x irradiation with 700 r from a PYM-11 apparatus at 41.4 r/min. The highest protective effect was obtained by an intraperitoneal injection of 150 mg/kg cystamine 30 min before exposure followed by a subcutaneous injection of 50 mg/kg antifein immediately after exposure (56% survival rate). An injection of 150 mg/kg cystamine 30 min before exposure followed by an injection of 50 mg/kg antifein immediately after exposure and intraperitoneal injections of vitamin B (1 mg/kg) for seven consecutive days after exposure resulted in a 60% survival rate. The narcotic drug barbamyl (100 mg/kg) inhibited the effect of antifein (20% survival rate), whereas chloral hydrate (also a narcotic drug), injected in a dose of 300 mg/kg immediately after exposure, increased the protective effect of antifein (100 mg/kg), resulting in a 58% survival rate. The data obtained indicate that the effectiveness of the preparations used depends on their chemical nature, dose, time, and sequence of administration. Activation and inactivation of the protective substances may occur simultaneously in the animal organism. (auth)

33762 COMPARATIVE CHEMICAL PROTECTION TO THE INTESTINAL AND HEMATOPOIETIC SYSTEMS OF WHOLE-BODY X-IRRADIATED MICE. Jean R. Maisin and David G. Doherty (Armed Forces Inst. of Pathology, Washington, D. C. and Oak Ridge National Lab., Tenn.). Radiation Res., 19: 474-84(July 1963).

Chemical protection by AET, MEA, D-2-ABT, APMT, serotonin, and a combination of AET and serotonin of the alimentary tracts of mice against 900, 1500, 2000, and 2500 r, and the hematopoietic system after 1500 r has been studied. AET and MEA offered the best intestinal protection, AET being superior to MEA at all dose levels. Doubling the optimal intraperitoneal dose of AET and MEA by oral administration failed to increase the degree of intestinal protection. Combined treatment with AET and serotonin, while providing better protection to the bone marrow than either alone, did not increase intestinal protection beyond that of AET alone. (auth)

33763 MODIFICATION OF IRRADIATION RESPONSE OF FEMALE RATS BY POPULATION DENSITY. E. W. Hahn and J. W. Howland (Univ. of Rochester, N. Y.). Radiation Res., 19: 676-81(Aug. 1963).

The 30-day survival of lethally x-irradiated rats was influenced by the number housed per cage after irradiation. The percentage of animals surviving 500 and 750 r was higher in singly caged groups than in groups caged in lots of 2 to 6 per pen. The onset of mortality after 750 and 1000 r was, likewise, later in singly caged than in multiply caged animals. (auth)

33764 PROTECTIVE EFFECTS OF CYSTEAMINE AND CYSTAMINE ON THYMOCYTES IRRADIATED "IN VITRO." E. H. Betz, G. Booz, and P. Lelièvre (Université, Liege). Rev. Franc. Etudes Clin. Biol., 6: 39-45(1961). (In French)

Both cysteamine and its oxidation product cystamine are to some extent toxic for a suspension of rat thymus cells. The toxicity varies with the suspension medium, being less in serum than in Krebs solution. The diminished toxicity

in serum probably results from protein fixation of cysteamine and cystamine. Cysteamine and cystamine protect the thymus cells against some effects of irradiation. Pyknosis and pyknolysis is inhibited in thymus cells irradiated in vitro. Although cysteamine causes a fall in oxygen concentration in the medium, this drop is not observed with cystamine, and the protective effect of the latter cannot be produced by an oxygen effect. (auth)

CHEMISTRY

General and Miscellaneous

33765 (GEAP-4278) ACCURATE NUCLEAR FUEL BURNUP ANALYSES. Quarterly Progress Report No. 6, March–May 1963. B. F. Rider, C. P. Ruiz, J. P. Peterson, Jr., and P. S. Luke, Jr. (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). June 1, 1963. Contract AT(04-3)-189. 29p.

Work has continued on the development of accurate methods for determining nuclear fuel burnup. Thermal flux capsule GEV-1, has completed its irradiation in MTR and its cooling period. Hardened flux capsule GEV-2 is presently in the VBWR and has received about 2×10^{19} nvt. A fast fission capsule GEV-3, containing uranium-238 and thorium-232 under cadmium, was fabricated and inserted in VBWR. Outstanding improvement in separation of neodymium from cerium and promethium by reversed phase chromatography on a D2EHP-wetted column is achieved by increasing the temperature to values in excess of 83°C. Such elevated temperature operation was made possible by changing the supporting medium from VYNS-type polyvinyl chloride-polyvinyl acetate copolymer which softens at 60°C to Chromosorb, a diatomaceous earth support, which is unaffected by the temperature employed. The work reported on fission product migration was continued with the analysis of specimen B high heat flux sample. The two specimens A and B have shown that movement of fission products can occur relative to uranium in molten fuel. (N.W.R.)

33766 (HW-77950) HEAVY WATER CLEANUP BY ELECTROPHORESIS. D. C. Boyd (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 1, 1963. Contract AT(45-1)-1350. 7p.

A method for the economic and efficient removal of colloidal and particulate suspensions from heavy water has been developed by General Electric Personnel at the Hanford Plutonium Recycle Test Reactor. This method, which is continuous and is designed to minimize the heavy water handling losses, utilizes the electrochemical process of electrophoresis coupled with standard filtration and ion exchange processes to effect the complete removal of the following contaminants: oil in colloidal suspension, oil in emulsion, finely divided particles of dust and rust in suspension, and metallic ions. Economic studies show that the process reduces the cost of removal, above by a factor of four over any previous method used at PRTR and is the only process found in an extensive study that will remove colloidal suspensions of oil from the heavy water. (auth)

33767 (IA-810) CATION EXCHANGE WITH MOLTEN SALTS. M. Liquornik and Y. Marcus (Israel. Atomic Energy Commission, Rehovoth). Jan. 1963. 13p.

The applicability of cation exchange between synthetic zeolites, such as Linde Molecular Sieve 4A, and molten salts, such as monovalent nitrates, was studied. It was found that sodium and silver nitrate were occluded in the cavities of the zeolite framework, with approximately nine to ten molecules occluded per unit cell of the zeolite. No occlusion was found with the larger thallium (I) ions. The exchange of silver and thallium for sodium from mixed nitrate melts was measured. The zeolite shows a preference for the former two ions over sodium ions. With thallium, no complete exchange could be obtained from nitrate melts. (auth)

33768 (ORNL-TM-541) UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT, JANUARY 1963. M. E. Whatley, P. A. Haas, R. W. Horton, A. D. Ryon, J. C. Suddath, and C. D. Watson (Oak Ridge National Lab., Tenn.). Aug. 12, 1963. Contract W-7405-eng-26. 84p.

A screen lined centrifuge bowl was demonstrated as a foam breaker at flow rates as high as 10 liters per hour. Good agreement of the calculated results with the experimental data was obtained for the reaction of H_2 and CO with CuO pellets in a fixed bed. Preliminary batch leaching tests of ThO_2–UO_2 stainless steel in HNO_3–NaF–$Al(NO_3)_3$ show slow dissolution because of poor penetration of acid in the layer of fines. The efficiency of a pulsed sieve-plate column at high flow ratios of aqueous to organic (50/1 and 100/1) was determined for the extraction of uranium by 30% TBP. High level waste calcining run R-71 using simulated Purex-65 waste is reported. (auth)

33769 (ORNL-TM-598) A STUDY OF THE ELECTRODELESS ELECTROLYTIC DISSOLUTION OF STAINLESS STEEL IN NITRIC ACID USING A MAGNETICALLY INDUCED POTENTIAL. C. A. Erdman and C. V. Chester (Oak Ridge National Lab., Tenn.). Sept. 3, 1963. Contract W-7405-eng-26. 26p.

A feasibility study of an electrolytic dissolver for stainless steel using an electromagnetically induced emf was made. The dissolver and process are very uneconomical due to inherent inefficiencies in electromagnetic coupling between the primary coil and the dissolving stainless steel pieces constituting the secondary. The required circuit parameters and performance of a feasible design were evaluated by experiments with a scaled analog of the device. The full size dissolver would consist of a 0.1 farad capacitor discharging at 675 volts once per second into 150 turns of water cooled copper tubing wrapped around a 2-in. pyrex pipe containing the stainless steel. Power input to the primary would be 22.8 kw, efficiency 0.01%, and dissolution rate about 5 mg/hr. Cost of the capacitor bank and silicon control rectifier bank would total about $5000. (auth)

33770 (PB-171980) DEVELOPMENT OF DEPLETED-URANIUM CATALYSTS FOR DESTRUCTION OF AIR POLLUTANTS IN AUTOMOBILE EXHAUST. Fiscal Year, 1961, Report of Research Progress. (Bureau of Mines, Washington, D. C.). 60p.

Feasibility tests on the use of depleted uranium for the catalytic oxidation of air pollutants in automobile exhaust were conducted under bench-scale, simulated engine, and actual road-use conditions. The catalysts used were uranium-based catalysts supported on activated alumina and a copper-chromium promoted, supported uranium oxide catalyst. The promoted catalyst gave a better performance than the unpromoted catalyst, and radiation monitoring indicated that no release of radioactivity occurred. (D.L.C.)

33771 (TID-17223) DEVELOPMENT OF KRYPTON-85 CLATHRATE ANALYTICAL TECHNIQUES TO MEASURE OXIDATION-REDUCTION PRODUCTS IN THE LIQUID STATE. Final Report. George J. Rotariu, Elizabeth L. Hoskins, and Donald M. Hattori (Booz-Allen Applied Research, Inc., Glenview, Ill.). July 1962. Contract AT (11-1)-1061. 98p.

Development was carried out on a new clathrate analytical technique useful for measuring low concentrations

of metal ions and SO_2 in liquids, and on a device employing this principle for use in process control. The trace chemicals to be investigated were SO_2 (g), ferric ion, cobaltic ion, and uranyl ion, and the technique to be developed was to have a specificity for the metallic ions, particularly for ferric ion. The basic technique investigated was a metal ion-complex reaction with radioactive hydroquinone: Kr^{85} in an inert liquid environment and this was developed for ferric ion. Reaction of ferric ion-TTA plus HCl (g) with this clathrate (all in trifluorotoluene) results in release of Kr^{85} proportionate to ferric ion concentration, in the 2 to 20 ppm range. A laboratory column prototype apparatus, suitable for process control use was built, but this did not give satisfactory results. The sodium chloride crystals used gave adsorption of ferric-TTA. Further development work is needed to determine an optimum substrate inert material for use in this column. The parts-per-billion range of ferric ion analysis was opened up through use of the fluorocarbon FC-43 (heptacosfluorotributylamine), but results indicated a peculiar inversion-like effect on the amount of Kr^{85} released, suggesting that the clathrate was made more stable by presence of TTA or ferric-TTA in this fluorocarbon. Two new reactions were uncovered in the SO_2 work. Little was done with the cobaltic and uranyl ions, beyond the complexing stage. (auth)

33772 X-RAY EVIDENCE OF PLUTONIUM(III) OXALATE DECAHYDRATE. D. M. Chackraburtty (Atomic Energy Establishment, Trombay, India). Acta Cryst., 16: 834(Aug. 10, 1963). (In English)

A bluish-white precipitate was obtained by adding excess of 0.06M oxalic acid in plutonium(III) solution, prepared by adding 1 ml of 10% hydroxylamine hydrochloride solution to 30 mg of plutonium (IV) in 0.5M nitric acid. By comparison of x-ray-diffraction data the decahydrate structure of $Pu_2(C_2O_4)_3 \cdot 10H_2O$ is postulated. (R.E.U.)

33773 APPLICATION OF THERMOGRAVIMETRIC TECHNIQUES AND DIFFERENTIAL THERMAL ANALYSIS IN THE STUDY OF REACTION KINETICS. Kwonghwa Hsueh. Hua Hseuh Tung Pao, No. 6, 27-30(1963). (In Chinese)

The termogravimetric and differential thermal analysis methods used in the study of reaction kinetics are reviewed. Thermogravimetry may be used for the study of the thermal decomposition of solid compounds with one or more volatile decomposition products while the differential thermal analysis is applicable to the thermal decomposition of solids as well as to that of liquids. Reliability of both methods depends greatly on the constancy of the temperature rise. The decomposition of $Th(C_2O_4)_2 \cdot 2H_2O$, $La_2(C_2O_4)_3 \cdot 10H_2O$, and $UO_2C_2O_4 \cdot 3H_2O$ and of lower hydrates of these compounds is used as example. (Review article). (TTT)

33774 DEUTERIUM ISOTOPE EFFECT ON GLASS TRANSFORMATION TEMPERATURES OF AQUEOUS INORGANIC SOLUTIONS. L. C. Shepley and A. B. Bestul (National Bureau of Standards, Washington, D. C.). J. Chem. Phys., 39: 680-7(Aug. 1, 1963).

Determinations were made on the effect of deuterium substitution on the glass transformation temperatures (T_g) evaluated for aqueous solutions of about 15 wt. % HCl and SO_3 by differential thermal-analysis measurements. Complete substitution of D_2O as the solvent shifted T_g from 128.1° to 131.8°K for the HCl solution and from 143.7 to 146.3°K for the SO_3 solution. This shift was linear with extent of D_2O substitution. If it were assumed that the potential-energy barriers to configurational changes in the supercooled liquid are not altered by deuterium substitution, the shifts could be interpreted as consistent with the proposition that the configurational changes which are immobilized when the solutions are cooled through the glass transformation involve simply the translation of single H_2O or D_2O groups. On this basis, translational frequencies around 200 cm^{-1} observed by Raman spectroscopy in water corresponded to potential-energy barriers around 2000 cal/mole. This was in rough agreement with hydrogen-bond energies of around 3000 cal/mole. This identification of the barriers with hydrogen bonds provides a reasonable support for assuming the barriers insensitive to deuterium substitution. (auth)

Analytical Procedures

Refer also to abstracts 33427, 33428, 35196, 35197, and 35198.

33775 (AD-287634) DEVELOPMENT OF ANALYTICAL TECHNIQUES FOR THE DETERMINATION OF MINUTE QUANTITIES OF SELECTED ELEMENTS IN BERYLLIUM. Interim Report No. 2, August 6, 1962 through October 6, 1962. (Battelle Memorial Inst., Columbus, Ohio). Oct. 25, 1962. Contract NOw 62-0629-c. 8p.

Two Be materials, one of high-purity distilled metal and another of a chemical-composition grade between the high-purity and commercial-quality metal, were obtained for initial analytical studies. Plans for the evaluation of these materials by several analytical techniques are outlined and the first phase of this work has begun. (auth)

33776 (AERE-R-4359) A MANOMETRIC METHOD FOR THE DETERMINATION OF MACRO QUANTITIES OF CARBON IN PLUTONIUM AND URANIUM CARBIDES. D. Crossley and E. Foster (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). May 1963. 11p.

A method is described for the determination of macro quantities of carbon in plutonium and uranium carbides. The method has also been applied to thorium carbide and can theoretically be used for the carbides of any of the actinide elements and their mixtures. The carbon dioxide produced by the combustion of the carbide in a stream of pure oxygen is measured by observing its pressure in a known volume at room temperature. The manometric apparatus is designed to measure 100 mg of carbon dioxide and at this level gives a precision (coefficient of variation) of 0.3%. The time taken for the determination is approximately half that required for the previously reported gravimetric method. (auth)

33777 (BNL-7146) NEUTRON-CHARGED PARTICLE REACTIONS. THE ANALYSIS OF THIN LITHIUM AND BORON FILMS. H. L. Finston, Y. Wellwart, and W. Bishop (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract AT-30-2-GEN-16. 17p. (CONF-151-1)

From 19th International Union of Pure and Applied Chemistry Congress, London, July 1963.

Thin Li^6F and B_2O_3 films were nondestructively analyzed by bombarding them with neutrons, obtaining the pulse-height distribution of the resultant charged particles, and determining the number of reactions from the area under each peak in the spectrum. The results agreed within the precision of this method with results of a flame analysis. This method is more accurate and sensitive than conventional neutron activation methods. (D.C.W.)

33778 (CONF-17-6) NEUTRON FLUX PERTURBATION IN ACTIVATION ANALYSIS. S. A. Reynolds and W. T. Mullins (Oak Ridge National Lab., Tenn.). [1963]. Contract [W-7405-eng-26]. 10p.

From Oak Ridge Radioisotopes Conference, Applications to Physical Science and Engineering, Gatlinburg, Tenn., April 1963.

Some effects of the neutron absorption and scattering characteristics of samples and comparators in activation analysis were evaluated in an experimental program including 21 elements. Induced specific activities in dilute aqueous solutions were compared with those in solid elements or compounds irradiated under the same conditions. Three factors affecting the neutron flux were investigated separately. These are: thermal neutron self-shielding by solid materials, resonance neutron self-shielding, and enhancement of thermal flux by moderation of epithermal neutrons within the aqueous samples. Results show that serious errors can arise in activation analysis through neglecting self-shielding and thermalization. Data and theory are in satisfactory agreement, and a simple basis was established for computations for cases where experimental data are unavailable. (N.W.R.)

33779 (CONF-67-27) NEW MONITORING MEANS FOR AIRBORNE TRITIUM DETERMINATION. David O. Clark and Carl Distenfeld (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract AT-30-2-GEN-16. 13p.

From Health Physics Society 8th Annual Meeting, New York, June 1963.

The method used at Brookhaven consists of freezing the water vapor out of a sample of air and then coincidence counting it on a liquid scintillator. The equipment used in the method is described. The method is satisfactory for the case where tritium is introduced in the form of water vapor, although in the case of T_2 or HT a spark discharge could be used to convert it into water vapor. Some experimental results are given. (D.L.C.)

33780 (CRDC-1157) A RAPID SPECTROGRAPHIC METHOD FOR THE DETERMINATION OF BERYLLIUM ON FILTER PAPER. G. J. Jarbo and G. Zotov (Atomic Energy of Canada Ltd., Chalk River, Ont.). May 1963. 9p. (AECL-1809)

Because beryllium is very toxic, rapid analytical techniques are needed to ensure that health hazards arising from its use in the laboratory are fully under control. In the past, samples on filter paper from air and surface sampling were analyzed by ashing, dissolving, and sparking a dried residue. A method was developed for sparking the filter paper directly using a previously incorporated cobalt standard. The filter paper is mounted on a disc-shaped electrode that is rotated and shifted back and forth beneath a fixed electrode so that the whole surface of the paper is explored. Be can readily be determined at levels significantly below those that indicate a health hazard. Time required for analysis is about ten minutes. (auth)

33781 (DP-798) A CONTROLLED-POTENTIAL COULOMETER WITH TRANSISTORIZED POWER AMPLIFIERS. Robert C. Propst (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). May 1963. Contract AT(07-2)-1. 31p.

A controlled-potential coulometer with transistorized power amplifiers is described. The instrument can be calibrated to ±0.01% of full scale. A coefficient of variation of only 0.04% was observed in 30 replicate analyses of solutions of uranium. (auth)

33782 (DP-831) PAPERS PRESENTED AT THE EIGHTH ANNUAL MEETING ON BIO-ASSAY AND ANALYTICAL CHEMISTRY, AUGUSTA, GEORGIA, OCTOBER 18-19, 1962. (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Contract AT(07-2)-1. 132p.

Nine papers are included which treat the determination of cesium, tritium, americium-241, plutonium, thoron, and other radionuclides under a variety of conditions. One treats the preparation of standard alpha sources. Separate abstracts were prepared for six of the papers; the remaining three papers were previously abstracted in NSA. (D.L.C.)

33783 (DP-831(p.5-20)) RADIOCHEMICAL DETERMINATION OF CESIUM AS THE HEXACHLOROSTANNATE. N. Golchert and J. Sedlet (Argonne National Lab., Ill.).

The determination of small amounts of radiocesium in natural materials by gamma-ray spectrometry is often complicated by the presence of fission products and other neutron-induced activities, as well as natural potassium. When these interfering activities reach sufficiently high levels, the cesium must be separated chemically for accurate counting. Cesium forms an insoluble hexachlorostannate in hydrochloric acid solution that can be used as the basis for such a separation. In this procedure decontamination from fission products and other interfering activities, except potassium, is accomplished by ferric hydroxide scavenging precipitations and by precipitation of the radiocesium (with cesium carrier) as the hexachlorostannate. Separation from the bulk of the potassium is obtained by precipitation of potassium chloride from hydrochloric acid-ethyl alcohol solution. Separation from the remaining potassium is accomplished by precipitation of cesium hexachlorostannate since the corresponding potassium salt is considerably more soluble. The final cesium hexachlorostannate precipitate may be counted by any suitable method. The procedure has been used to determine radiocesium in water, precipitation, milk, soil, vegetation, air particulates, and urine. (auth)

33784 (DP-831(p.21-37)) THE RADIOCHEMICAL DETERMINATION OF Cs^{137} IN COMPLEX MATRICES. W. R. Collins, Jr. (New York Operations Office. Health and Safety Lab., AEC).

A radiochemical method for the determination of cesium-137 in 100-gram soil samples is presented. The radiocesium and added cesium carrier are equilibrated by fusion with sodium carbonate and separated from bulk constituents in soil by leaching the melt with hot water. Cesium is separated from sodium by batch extraction onto ammonium phosphomolybdate and separated from potassium and rubidium by reprecipitation of the phosphomolybdate derivative in the presence of excess ammonium ions. Molybdenum is removed by precipitation as calcium molybdate and ammonia by volatilization from acid solution. Cesium is finally collected as the chloroplatinate and assayed gravimetrically and radiometrically. Adaptations of the basic soil technique to other matrices are discussed. Preliminary soil, food, and bone data are presented. (auth)

33785 (DP-831(p.38-45)) OBSERVED EFFECTIVE HALF LIFE OF TRITIUM AT THE SAVANNAH RIVER PLANT. H. L. Butler (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.).

Two hundred-sixty assimilations of tritium, approximating one millicurie, have occurred at the Savannah River Plant in the past five years. Half life observations, and efforts to correlate these values with variables, are discussed. (auth)

33786 (DP-831(p.46-57)) N. S. SAVANNAH BIO-ASSAY PROGRAM. G. W. Royster, Jr. and B. R. Fish (Oak Ridge National Lab., Tenn.).

In support of the N. S. Savannah Medical Program,

shipboard procedures have been established for detecting significant exposures to internal radioactive contamination and for estimating radionuclide deposition in body organs. As a result of space and equipment restrictions on board ship, all procedures were necessarily simplified so as to entail a minimum of processing. Direct counting of raw urine samples by gamma ray spectrometry was found to provide adequate sensitivity for detecting significant chronic or acute internal exposures to gross mixtures of radioactive corrosion products or fission products. The employment of a collimated 3-in. × 3-in. NaI(Tl) crystal to scan selected portions of the body offers sufficient sensitivity to provide estimates of organ burdens. Lung burdens of five per cent of the maximum permissible levels for individual major corrosion or fission products may be detected easily. (auth)

33787 (DP-831(p.58-63)) A METHOD FOR DETERMINING LOW LEVEL ALPHA ACTIVITY FROM AMERICIUM^{241}, CURIUM^{244}, AND CALIFORNIUM^{252} IN BIOLOGICAL MATERIALS. Anne deG. Low-Beer and Troy L. Story, Jr. (California. Univ., Berkeley. Lawrence Radiation Lab.).

The nuclides are coprecipitated with lanthanum fluoride. Separation is effected on specially designed small columns, using a series of three different ion exchange resins. The final eluate is collected on platinum and counted directly by pulse height analysis. The method is sensitive enough to detect activities as low as 0.3 dpm, and is applicable to both urine and tissues. Volumes involved in the chromatographic steps are small, so that separation can be carried out in about two hours. Identification of nuclides is made by pulse height analysis, so that the method is useful when a single nuclide is present or when two or more are present in combination. (auth)

33788 (DP-831(p.81-90)) DETERMINATION OF PLUTONIUM IN BIOLOGICAL SAMPLES. Taft Y. Toribara and Carol Predmore (Rochester, N. Y. Univ. School of Medicine and Dentistry).

The analysis of plutonium in dogs exposed to an aerosol containing the element required special treatment for some of the samples. The final estimation was made through the liquid scintillation counting technique and a separation scheme was necessary to isolate the element. The separation scheme itself was very simple and consisted of the absorption of a chloride complex of plutonium on an anion exchange column with subsequent elution. For certain samples the problem of getting the plutonium in a soluble form suitable for absorption by the resin was the most difficult. (auth)

33789 (EUR-224.i) MICROANALISI DELLE IMPURITÀ DELL'ACQUA DISTILLATA PRODOTTA PER IL CIRCUITO PRIMARIO DI UN REATTORE NUCLEARE PER LA PROPULSIONE NAVALE. (Microanalysis of Impurities in Sweet Water Produced by the Primary Circuit of a Nuclear Reactor for Marine-Propulsion). A. Sommariva (Ansaldo S. p. A., Genoa). 1963. 29p.

Various analytical methods were developed for determining any impurities present in the water produced by a ship's evaporators. The determinations can be made for magnesium, calcium, iron, copper, silicon, chlorides, sulfates, sodium, and organic materials. In connection with the analyses of each element, the principle underlying the method employed is outlined as well as the reagents used, the analytical procedure to be followed, and the relevant discussion. The analytical results are listed with reference to the analyses of the water produced by the evaporators of the turbine vessel "Leonardo da Vinci." The analytical procedures dealt with, as well as providing useful information on the planning of the demineralization plant of a nuclear-powered tanker, will be able to be used as the technical basis for the check analysis of the primary circuit water in PW and BW reactors. (auth)

33790 (EUR-270.e) X-RAY ABSORPTION AS AN ANALYTICAL TOOL IN NUCLEAR CHEMISTRY. C. J. Toussaint (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 13p.

Among x-ray analyses, little attention was previously paid to x-ray absorption possibilities, in respect to x-ray diffraction and x-ray fluorescence analysis. The different kinds of absorption techniques are described, and each technique is followed by some applications concerning particularly the nuclear chemistry field. The absorption analysis methods include fine structure determination of absorption spectra of the nuclides (a more fundamental investigation) and the absorption-fluoresence method for the determination of cladding thickness of nuclear fuel elements. The absorption-edge method has the advantage of a relative freedom from both direct and matrix interferences. It is a nondestructive method, and a wide range of elements can be determined. Precision and accuracy of the method are fairly good. The determination of each element requires generally from 15 minutes to 1 hour, with a dissolved sample, and only a small amount of solution is needed (0.2 to 2 ml.). Disadvantages arise from the limit of concentration which can be determined (generally 0.05 g/l). (auth)

33791 (HW-77538) CONTINUOUS MEASUREMENT OF TRACE CONCENTRATIONS OF HARDNESS IN WATER. T. F. Demmitt and M. C. Burt (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 1963. Contract AT(45-1)-1350. 16p.

Results are presented of an evaluation of a procedure using magnesium versenate and Eriochrome Black T for continuous measurement of trace amounts of hardness in deionized water. The analytical procedure and instrumentation used are also described. The procedure is capable of measuring hardness concentrations as low as 10 ppb calcium carbonate with a precision of ±10% at the 10 ppb level and ±5% at the 125 level. The procedure will be used for hardness measurement in the N-Reactor secondary coolant stream. (auth)

33792 (IDO-14609) MANUAL OF ANALYTICAL METHODS FOR EXPERIMENTAL ORGANIC COOLED REACTOR. R. C. Shank—T. D. Morgan, ed. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). June 25, 1963. Contract AT(10-1)-205. 172p.

The methods described are principally for the determination of properties of terphenyls and were developed for providing analytical service to the Operations and Technical Groups of the Experimental Organic Cooled Reactor. (auth)

33793 (PG-Report-441) ANALYTICAL METHOD FOR THE SPECTROGRAPHIC DETERMINATION OF CALCIUM IN REACTOR GRADE ZIRCONIUM AND ITS ALLOYS. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1963. 13p.

The sample, after dissolution, is spectrographed by the rotating graphite disc technique using high voltage spark excitation. The spectra are recorded through a grating spectrograph and are evaluated by an intensity method using Zr as internal standard. The method is suitable for the determination of 20 to 100 ppm of Ca in Zr and its alloys containing up to 0.1% Hf and 0.5% of Cu and Mo. The standard deviation of the method is ±1 ppm at the 30 ppm level using aliquots from a bulk solution. (P.C.H.)

33794 (PG-Report-442) ANALYTICAL METHOD FOR THE ASSAY OF PLUTONIUM OXIDE (DIFFERENTIAL SPECTROPHOTOMETRY). (United Kingdom Atomic Energy Authority. Production Group. Windscale, Sellafield, England). 1963. 4p.

A solution of the oxide in nitric acid is prepared, hydrochloric acid is added, and the relative absorbancy of the solution is measured at 565 mμ against that of a plutonium reference standard. The method is intended for the assay of routine production plutonium oxide. The precision (three times the standard deviation) of the procedure applied to metal samples is ±0.28%. The precision is judged to be ±0.4%. The method is an adaptation of one developed by F. Barker (PG Report 290 (W)). (auth)

33795 (PG-Report-449) ANALYTICAL METHOD FOR THE VOLUMETRIC DETERMINATION OF FLUORIDE IN PLANT EFFLUENTS. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1963. 7p.

Fluoride is steam distilled as hydrofluosilicic acid in the presence of H_2SO_4. The fluoride is then determined in the distillate by titration with Th nitrate using alizarin red S or chrome azurol as indicator. At the 250 μg/ml fluoride level the standard deviation is 3 μg. (P.C.H.)

33796 (PG-Report-462) ANALYTICAL METHOD FOR THE DETERMINATION OF ALKALI METALS (FLAME PHOTOMETRY). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1963. 5p.

The alkali metals in the sample are excited in a hydrogen burner, and the intensity of one line from the spectrum of each element is measured and compared with a calibration graph prepared from standards. It is estimated that the precision (three times the standard deviation) is better than ±10%. The concentration ranges are: Na, 0.001 to 100 μg/ml; K, 0.001 to 100 μg/ml; Cs, 0.005 to 100 μg/ml; Rb, 0.025 to 100 μg/ml; and Li, 0.001 to 100 μg/ml. The lower limits may not be attainable if large amounts of other elements are present. No interference was observed with up to 300 μg/ml of ammonium phosphate present. Tests on mixed alkali standards up to 100 μg/ml of each showed negligible interference provided that accurate background measurements are taken and corrections made. The method is intended primarily for samples of fresh water and biological materials. (auth)

33797 (PG-Report-469) THE DETERMINATION OF (A) TRITIATED WATER AND (B) TRITIUM AND TRITIATED HYDROCARBONS IN REACTOR COOLANT GAS. (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1963. 16p.

Tritiated water is washed from the gas, purified, and the β activity measured. The carbon dioxide in the dried gas is absorbed in potassium hydroxide and the hydrogen and hydrocarbons in the residual gas oxidized. The water produced is purified and its β activity measured. The method is applicable to a concentration range of 10^4 to 10^8 dpm/liter of coolant. (auth)

33798 (PG-Report-475) ANALYTICAL METHOD FOR THE DETERMINATION OF THE RESIDUAL GAS IN GASEOUS CARBON DIOXIDE AFTER ABSORPTION WITH POTASSIUM HYDROXIDE (HIGH LEVELS OF IMPURITY). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1963. 9p.

A suitable volume of CO_2 is collected over saturated brine, and the CO_2 is absorbed with KOH solution. The residual gas is measured in a narrow graduated tube. Details are given for the transfer of the residual gas to allow mass spectrometric examination if required. (auth)

33799 (PG-Report-476) ANALYTICAL METHOD FOR THE GRAVIMETRIC DETERMINATION OF COPPER AND NICKEL IN DILUTE HYDROFLUORIC ACID. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1963. 5p.

Hydrogen fluoride is removed by evaporation, and the residue is dissolved in dilute H_2SO_4. Copper is determined electrolytically and Ni gravimetrically using dimethylglyoxime. The sum of Fe, Co, and Mn should not exceed 5% of the Ni level or inaccurate results will be obtained. The precision of the Ni determination calculated from the differences between 30 pairs of duplicate determinations in the range 0.5 to 2 mg/ml Ni is ±0.012 mg/ml (1 × sigma). (P.C.H.)

33800 (PG-Report-477) ANALYTICAL METHOD FOR THE DETERMINATION OF THE OIL CONTENT OF LIQUID CARBON DIOXIDE. (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1963. 8p.

A sample of liquid CO_2 is collected in an oil-free sample cylinder. The liquid is gasified and the gas passed through a bubbler containing CCl_4. When all the liquid has vaporized, the cylinder and fittings are rinsed with CCl_4. The CCl_4 is examined in an infrared spectrometer, the absorption of 2890 cm^{-1} being used to give a measure of the oil concentration. (auth)

33801 (TID-3575) ACTIVATION ANALYSIS. A Literature Search. Henry D. Raleigh, comp. (Division of Technical Information Extension, AEC). Aug. 1963. 30p.

Included are 391 selected references on the use of radioactivation in the qualitative and quantitative analysis of materials. Report and open literature references were obtained from NSA through June 30, 1963. The references are arranged alphabetically by first author. An index is included in three parts: reviews and general interest, analyzed materials, and elements determined. (N.W.R.)

33802 (TIM-711) NaK SAMPLING OF ENGINEERING TEST RIGS. C. E. Woodward (Pratt and Whitney Aircraft Div., United Aircraft Corp. Connecticut Aircraft Nuclear Engine Lab., Middletown). Feb. 23, 1962. Contract AT (11-1)-229. 19p.

A method was developed for sampling of NaK at elevated temperatures in engineering test rigs for analysis of the oxide content. The method consists of controlled vacuum withdrawal and is successful when access to a representative source of the NaK is available and when the gas pressure in the vessel being sampled does not exceed 2 psig. Some analytical results are given. (D.L.C.)

33803 CONTINUOUS ELEMENTAL ANALYSIS OF GAS CHROMATOGRAPHIC EFFLUENTS. APPLICATION TO THE ANALYSIS OF LABELED COMPOUNDS. Fulvio Cacace, Romano Cipollini, and Giorgio Perez (Universith, Rome). Anal. Chem., 35: 1348-52(Sept. 1963).

A technique is described that allows the continuous elemental analysis and radiometric analysis of C^{14}-labeled compounds separated by gas chromatography. The substances emerging from the column are converted into CO_2 and H_2, which are separated on an auxiliary column. From the ratio of the areas of the H_2 and CO_2 peaks, the H : C ratio in each substance is deduced. The activity of the CO_2 peak is assayed by a 100-ml flow ionization chamber or a 100-ml internal flow proportional counter, depending on the specific activity of the sample. The method may be employed to determine the total activity in a given com-

pound and its specific activity in one operation. Because of the separation of the H and C contained in each compound, the method shows considerable promise for simultaneous C^{14} and H^3 assay in doubly labeled molecules. (auth)

33804 SPECTROPHOTOMETRIC ESTIMATION OF ZIRCONIUM AS REDUCED MOLYBDOSULFATOZIRCONIC ACID. G. C. Dehne and M. G. Mellon (Purdue Univ., Lafayette, Ind.). Anal. Chem., 35: 1382-6(Sept. 1963).

The reduction product of a complex molybdosulfatozirconate is used as the basis of a spectrophotometric method for the estimation of zirconium(IV). Factors affecting the color reactions are given. The useful range of the method for a 1-cm cell is 5 to 25 mg per liter. A new type of heteropoly complex is proposed as the reducible intermediate. (auth)

33805 THE SPECTROPHOTOMETRIC DETERMINATION OF SCANDIUM IN COPPER WITH XYLENOL ORANGE. S. S. Berman, G. R. Duval, and D. S. Russell (National Research Council, Ottawa). Anal. Chem., 35: 1392-4(Sept. 1963).

A spectrophotometric procedure for the determination of microgram quantities of scandium was developed using xylenol orange as the color-forming reagent. The sensitivity is 0.002 μg per cm^2 for log $I_0/I = 0.001$ at 553 mμ. Beer's law is adhered to from 0.5 to 1.7 ppm scandium and concentrations ranging from 0.1 to 2 ppm can be estimated with measurements made in 1-cm cells. When present at the level of 1 μg per ml, only Th, Fe, fluoride, and phosphate of a variety of elements and anions tested produced interference. A method for the determination of scandium in copper is described. The copper is removed as the chloro complex on an anion exchanger. After treatment of the eluate to remove hydrochloric acid, the scandium is estimated spectrophotometrically using xylenol orange. Scandium was determined on a range of synthetic copper–scandium standards with a relative standard deviation of ±1.5% for 20 μg of scandium. (auth)

33806 DIRECT ANALYSIS OF OXYGEN-18 IN ORGANIC COMPOUNDS. C. Gardner Swain, Gen-ichi Tsuchihashi, and Lynn J. Taylor (Massachusetts Inst. of Tech., Cambridge). Anal. Chem., 35: 1415-17(Sept. 1963).

By repeated scanning of the molecular-weight regions of mass spectra and careful measurement of peak intensities, it is possible to determine the oxygen-18 content of many organic compounds without the need for chemical conversions and with a precision sufficient for most tracer and isotope-effect experiments, provided the tracer enrichment is about 5%. (auth)

33807 A RAPID AND SIMPLE METHOD OF DEUTERIUM DETERMINATION. Edward M. Arnett and Peter McC. Duggleby (Univ. of Pittsburgh). Anal. Chem., 35: 1420-4(Sept. 1963).

An improved procedure for generating HD–H_2 from mixed isotopic water samples for deuterium determination by thermal conductivity uses standard gas chromatography apparatus. The method is at least as accurate and precise as other common techniques for deuterium assay and is much faster, more convenient, and easily learned. It does not require purification of the water and may be used routinely over the entire range of D_2O–H_2O solutions down to background levels. Safety precautions for handling hydrogen as a GLC carrier gas are described. (auth)

33808 CHLOROSTANNATE METHOD FOR SEPARATION OF RADIOCESIUM. C. F. Goeking, C. L. Ghann, and E. I. Wyatt (Oak Ridge National Lab., Tenn.). Anal. Chem., 35: 1434-6(Sept. 1963).

A rapid and reliable method was developed for the separation of radiocesium from fission-product mixtures. Stannic chloride is used to precipitate cesium selectively as cesium chlorostannate, Cs_2SnCl_6, from a 50 (v/v) % solution of concentrated HCl in ethyl alcohol. Usually, the major portion of contaminants is removed by one scavenging step followed by two precipitations of cesium. The method is comparable with the perchloric acid and tetraphenylboron precipitation methods for cesium with respect to decontamination factors, carrier yields, analytical time, and accuracy. It was applied satisfactorily to a variety of samples. (auth)

33809 RADIOCHEMICAL SEPARATION OF BISMUTH BY AMALGAM EXCHANGE. F. E. Orbe, I. H. Qureshi, and W. W. Meinke (Univ. of Michigan, Ann Arbor). Anal. Chem., 35: 1436-8(Sept. 1963). (TID-18651)

The radiochemical separation of bismuth by amalgam exchange in an aqueous sulfuric acid system was critically evaluated. The bismuth amalgam exchange step is followed by a back-extraction with saturated cupric sulfate in 1.0N nitric acid for selective removal of bismuth from the mercury phase. Bismuth yields of 97.5% were obtained with less than 0.1% contamination from most typical elements. Mineral acids below 2.0M do not affect the exchange. At room temperature the overall separation requires about 10 minutes; at higher temperatures, about 4 to 5 minutes. (auth)

33810 DETERMINATION OF OXYGEN IN PYROLYTIC GRAPHITE-COATED URANIUM CARBIDE BY USE OF A CURRENT-CONCENTRATOR FURNACE. M. E. Smith, J. M. Hansel, R. B. Johnson, and G. R. Waterbury (Los Alamos Scientific Lab., N. Mex.). Anal. Chem., 35: 1502-5 (Sept. 1963). (LADC-5762)

An inert carrier–gas method was modified for the determination of low concentrations of oxygen in highly refractory materials by incorporating the use of a current-concentrator furnace to obtain higher temperatures. Operating temperatures ranging between 2400 and 2800°C were readily attainable, and relatively low blanks, between 10 and 30 μg of oxygen, were obtained with the modified apparatus. The method was applied to the determination of oxygen in uranium carbide particles coated with pyrolytic graphite. A temperature of 2500°C is sufficient to rupture the shells of the particles and release the oxygen, which is converted to carbon dioxide and measured manometrically. The relative standard deviations of the method for coated particles are ±10% at the 1000-ppm oxygen concentration level, based upon 79 determinations, and ±12% at the 75-ppm level, based upon 15 determinations. (auth)

33811 CATHODIC ACTION OF THE URANYL–GLYCOLATE COMPLEX AT THE DROPPING MERCURY ELECTRODE. Tsai-teh Lai, Shou-nan Chen, Bi-cheng Wang, and Ching-chiang Hsieh (Cheng Kung Univ., Taiwan, China). Anal. Chem., 35: 1531-3(Sept. 1963).

The uranyl–glycolate complex system was studied at 30°C by polarography. The half-wave potential vs pH plots broke at pH 3.8 (when $\mu = 0$), which was equal to the pK value of the glycolic acid. The compositions of the complexes were confirmed to have metal–ligand ratios of 1:1 and 1:2 by conductometric measurement. The electrode reactions were deduced to be $UO_2G_2 + H^+ + e^- = UO_2G + HG$ pH < 4.1 and $UO_2G_2 + e^- = UO_2G + G^-$ 4.1 < pH < 5.1. Above pH 5.1, the uranyl ion was complexed with hydroxyl ion in preference to glycolate ion, and this rendered the reduction irreversible. The diffusion current was proportional to concentration of uranium from 1.0×10^{-4}M to 3.5×10^{-3}M with ±2% relative standard deviation. (auth)

33812 SPECTROPHOTOMETRIC DETERMINATION OF NIOBIUM IN URANIUM–FISSION ELEMENT ALLOYS. J. J. McCown and D. E. Kudera (Argonne National Lab., Idaho Falls, Idaho). Anal. Chem., 35: 1545-6(Sept. 1963).

A method is reported for the spectrophotometric determination of as low as 0.01% niobium in uranium fission element alloys (fissium). The method involves forming NbSCN complex in a mixture of tartaric, sulfuric, and hydrochloric acids and extraction into ethyl acetate. The absorbance is measured at 385 mμ. The procedure was tested on synthetic solutions containing known amounts of U, Mo, Ru, Pd, Rh, Zr, and Nb and was satisfactory. Unirradiated U–5% fission element alloys having a nominal composition of 0.01% Nb were analyzed by the thiocyanate method and were found to contain 0.011% Nb. (P.C.H.)

33813 RAPID SCANNING OF RADIOACTIVE THIN LAYER CHROMATOGRAMS. Joseph Rosenberg and Michael Bolgar (Tracer Lab. Inc., Waltham, Mass.). Anal. Chem., 35: 1559-60(Sept. 1963).

A simple convenient method is described by which radioactivity on thin layer chromatoplates can be scanned rapidly. Depending on the coating thickness and the slit width and time constant of the scanner, the efficiency was about 2%. The continuous scanning system is described. (P.C.H.)

33814 PREPARATION OF DEUTERATED SOLVENTS FOR NUCLEAR MAGNETIC RESONANCE SPECTROMETRY. P. J. Paulsen and W. D. Cooke (Cornell Univ., Ithaca, N. Y.). Anal. Chem., 35: 1560(Sept. 1963).

Methods are reported for the preparation of deuterated acetone and chloroform for nuclear magnetic resonance spectrometry. The materials cost of one batch of deuterated acetone equals the cost of 100 ml of heavy water or about 20 cents per gram of deuterated acetone. (P.C.H.)

33815 DETERMINATION OF TRACES OF FREE ACID IN URANYL SALT SOLUTIONS. J. Marshall and A. Barnun (Israel Atomic Energy Commission, Tel-Aviv). Anal. Chim. Acta, 29: 22-6(July 1963). (In English)

A method for the determination of free acid in the presence of uranium(VI) is suggested. It involves the extraction of U by TBP from a solution saturated with KNO_3 or KCl in order to prevent interference from the hydrolysis of U. The end point is detected potentiometrically at pH 3.4. The method is suitable for the determination of 0.1 to 1.5 millimoles of acid in the presence of as much as 1.0 millimole of U. (auth)

33816 ANALYTICAL POSSIBILITIES OF A SERIES OF NEW AROMATIC-TYPE CHELATE COMPOUNDS. A. J. Cameron, N. A. Gibson, and R. Roper (Univ. of Sydney). Anal. Chim. Acta, 29: 73-5(July 1963). (In English)

A study was made of the visible spectra of a number of metal ions in the presence of 1,3-bis(2′-pyridyl)-1,2-diazaprop-2-ene in order to evaluate their analytical possibilities. The metals tested were: Mg, Ca, Sr, Ba, Al, La, Ce, U, Ti, Zr, V, Cr, Mo, W, Mn, Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, Cu, Ag, Au, Zn, Cd, Hg, In, Tl, Sn, Pb, As, Sb, and Bi. An Fe(III) solution at pH 4.2 changed, on standing, from an initial pale yellow to an orange-red color, which essentially reached maximum intensity after 30 min. The observed color intensities of Co, Ni, Zn, Cu, Pd, Cd, and Fe(II) solutions were high, especially in view of the fact that the metal concentration was only 2 μg/ml in all cases. (P.C.H.)

33817 A NEW MICROSCOPIC CRYSTAL TEST FOR BERYLLIUM WITH HEXAMMINOCOBALT(III) CHLORIDE. J. W. L. van Ligten and W. Cool (Technical Univ., Delft, Netherlands). Anal. Chim. Acta, 29: 89-92(July 1963). (In English)

Hexamminocobalt(III) chloride was found to offer a sensitive test for the microscopic determination of Be. A droplet of Be solution is placed on the edge of a slide. If the solution already contains ammonium carbonate, a small drop of a 3% $Co(NH_3)_6$ is placed in the immediate neighborhood and moved into the first drop with a Pt wire. Pale yellow-brown regular triangles and skeletons indicate a positive test for Be. The limit of identification of Be (0.1 μg) is not affected by the presence of 200-fold amounts of U. (P.C.H.)

33818 A RAPID SOLVENT-EXTRACTION SAMPLING TECHNIQUE FOR NEUTRON-ACTIVATION ANALYSIS. T. B. Pierce and P. F. Peck (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Analyst, 88: 603-7 (Aug. 1963).

A solvent-extraction sampling technique was used for comparing the specific activity of an element separated from an irradiated sample with that of an irradiated standard after both have been diluted with inactive carrier. The method was used to provide a rapid separation and determination of silver, the activity of the 2.3-minute Ag^{108} nuclide being measured. (auth)

33819 SYSTEMATIC ANALYSIS OF ZIRCONIUM AFTER NEUTRON IRRADIATION. Louis Fournet (Centre d'Etudes de Chimie Metallurique, Vitry-sur-Seine, France). Ann. Chim. (Paris), 7: 763-84(Nov.-Dec. 1962). (In French)

General principles of analyses using neutron activation are discussed, a method for analysis of Zr is described, and subsidiary procedures for estimation of halogens, N, Al, V, Mg, and Ti in metal samples are presented. Zirconium was refined by the Kroll procedure or by the Van Arkel technique involving thermal decomposition of the iodide. Such Zr samples contain 8–10 elements as well as other impurities. After irradiation of a 1-g sample of Zr for 1 week at a neutron flux of 1 to 1.4×10^{12} $n/cm^2/sec$, it is possible to determine, with a high degree of accuracy, 48 elements. By resin chromatography Hf may be separated and estimated at concentrations of the order of 10×10^{-6} and Ta at 1 to 2×10^{-6} in 20–40 mg samples. The limits of detection of other metals in Zr are very high. In Zr prepared by the Van Arkel method the concentrations of Fe, Cu, Cr, Al, Mn, Ni, Ag, As, Ga, Co, Sb, and U are about $^1/_{10}$ those in Zr refined by the Kroll method. In contrast, the Na and Hf contents are about the same. The Au content of Van Arkel Zr is widely variable (0.05 to 2×10^{-6}) and I is introduced during the refining procedure. Nitrogen content is readily determined after neutron irradiation, and high values (12 to 40×10^{-6}) were obtained in Van Arkel-refined Zr; N content of Kroll Zr is very uniform (19 to 21×10^{-6}). The Zr content of the Kroll product is 99.93%, compared with 99.985% for Van Arkel samples. (TCO)

33820 THE SPECTROSCOPY OF SHOCK-EXCITED POWDERED SOLIDS. R. W. Nicholls (Univ. of Western Ontario, London, Can.), W. H. Parkinson, and E. M. Reeves. Appl. Optics, 2: 919-30(Sept. 1963).

The shock tube is shown to be an excellent spectroscopic source for controlled thermal excitation of astrophysically interesting spectra. Spectroscopic studies of the luminosity from shock-excited powdered solids are discussed in detail. A wide range of inorganic oxides, nitrides, hydrides, carbides, and sulfides and other compounds were treated in addition to samples of meteorite. A few aromatic organic materials were also studied. Time-resolved emission and

absorption techniques were used. Spectra of most inorganic materials change from molecular to atomic with increase in shock Mach number, and an over-all thermal excitation mechanism appears to be most probable. The situation with organic materials, which have lower melting points, appears to be more complex. (auth)

33821 EXPERIENCE WITH THE VISUAL FLUORESCENCE DETERMINATION OF URANIUM (IN EFFLUENTS). E. Singer and L. Sisler. Chem. Prumysl., 12: 350-2(1962).

For the separation of U, add methyl violet solution then HNO_3 (1:4) or aqueous NH_3 (1:4) to 2 ml of the sample, an acid effluent, which may contain large amounts of impurities that suppress the uv fluorescence, until the liquid turns blue. Add $Al(NO_3)_3$ solution [900 g of $Al(NO_3)_3 \cdot 9H_2O$ in 1 l of H_2O] (2.5 ml) and 10% tributyl phosphate solution in hexane (2 ml), and shake for 30 sec. For the determination, a borax bead is immersed in the separated organic layer containing U, and the fluorescence intensity in uv light is compared with the standards. The error is > ± 30%. The method is suitable for determining 3×10^{-9} to 3×10^{-7} g of U, and a determination takes ~4 min. (TCO)

33822 SEVERAL APPLICATIONS OF USE OF RADIOELEMENTS IN THE ANALYSIS OF METALS. A. Kohn. Chim. Anal. (Paris), 44: 425-32(Oct. 1962). (In French)

The uses of radioactive tracer analysis to determine Ta content in Nb ore, ferroniobium, La, Ce, and As in steel, Ni, Mn, As, and Cu in Armco iron, and to study the oxidation of Fe–As systems, intergranular corrosion of stainless steels, and electrolytic separation of Fe and FeO was investigated. (Rev. Metal Lit., 19: No. 3, March 1963)

33823 RADIOMETRIC PLUTONIUM DETERMINATION IN THE PRESENCE OF LARGE URANIUM EXCESS IN THE ORGANIC PHASE OF THE PUREX PROCESS. S. Havelka and M. Beran (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rež). Collection Czech. Chem. Commun., 28: 1603-6(June 1963). (In German)

For the control of the plutonium content in the organic phase of the Purex Process, the plutonium must be determined in the presence of uranium in a plutonium–uranium ratio of $1:10^6$. A radiochemical method was developed for plutonium determination in TBP containing 0.2M HNO_3 and 0.35M $UO_2(NO_3)_2$. For plutonium separation, the reextraction by means of an iron(II) amidosulfonate solution, oxidation by a sodium nitrite solution, and further extraction in a 0.5M TTA solution in xylene were carried out. For a 10^{-6}M plutonium solution, a reproducibility of ±3% was obtained by this method. (M.C.G.)

33824 POLAROGRAPHIC DETERMINATION OF ZIRCONIUM AND HAFNIUM WITH EDTA. Kuan Pan, Peng-Joung Sun, and Wen-Kuei Wong (National Taiwan Univ., Taipei). J. Chinese Chem. Soc. (Taiwan), 8: 298-305(Dec. 1961).

Zirconium (IV) and hafnium (IV) ions undergo hydrolysis and polymerization in aqueous solutions so readily that in the absence of complexing agents precipitation begins at pH 3 and is complete at pH 5. But in the presence of Na salts of ethylenediaminetetraacetic acid (EDTA), the precipitation is prevented at pH values up to 9-10. By application of the polarographic method to a Cd EDTA system, the determination of Zr and Hf was extended to solutions of concentration as low as 10^{-6}M, or 0.1 ppm. Results were compared with those obtained by potentiometric titration of the free Cd ion in the concentration range of 10^{-3} to 10^{-4}M. The electrolytic solution was prepared by addition of desired amounts of 0.012M $CdCl_2$, 0.010M EDTA, 0.3 ml of 0.4% thymol, then 0.01M Zr or Hf chloride of a desired volume to 10 ml 0.5M acetic acid, with a calibrated microburet, and adjusting the pH by drop-wise addition of N NaOH. After addition of each drop of NaOH, the solution was allowed to attain constant pH before addition of more reagent. The mixture was allowed to stand for 2 hr to attain equilibrium. pH was checked again before the polarographic measurement and total volume was adjusted to 50 ml with water so that the resulting solution contained 0.012 M Cd and 0.010M EDTA and a desired concentration with respect to Zr and Hf. The ionic strength was maintained constant at 0.1. For comparison, Zr and Hf were potentiometrically determined with EDTA, using Cd amalgam as an indicator electrode and saturated calomel electrode as the reference electrode. A relative deviation of 4 to 9% was observed over the concentration range of 10^{-3} to 10^{-4}M, and no reliable data were obtained for Zr and Hf at concentrations less than 10^{-4}M. (H.H.D.)

33825 QUANTITATIVE PAPER RADIOCHROMATOGRAPHY USING TOLLENS REAGENT. II. AMMONIACAL SILVER NITRATE REAGENTS CONTAINING LESS THAN EQUIMOLAR PROPORTIONS OF AMMONIA FOR THE OXIDATION OF SACCHARIDES ON PAPER CHROMATOGRAMS. Janusz Z. Beer (Inst. for Nuclear Research, Warsaw). J. Chromatog., 11: 247-52(June 1963). (In English)

Ammoniacal silver nitrate reagents possessing higher reactivity towards saccharides than Tollens reagent are described. The highest reactivity is shown with unstable reagents containing about equimolar amounts of silver nitrate and ammonia. Acetone–water solutions of the reagents can be added to paper chromatograms of saccharides by dipping. (auth)

33826 RAPID NON-DESTRUCTIVE ANALYSIS OF CHLORINE BY NEUTRON ACTIVATION. Minoru Okada (Government Chemical Industrial Research Inst., Tokyo) and Yuichiro Kamemoto. Nature, 199: 276(July 20, 1963).

A technique for non-destructive analysis of chlorine based on properties of Cl^{38} was devised. Samples were irradiated in a reactor for 2.5 seconds, cooled for 5 seconds, and counted for 1 second. Identification of the Cl in the samples as Cl^{38} was confirmed. Though U has a relatively low cross section, it is concluded that the method is applicable to various organic compounds. (H.M.G.)

33827 COMPARATIVE URANIUM AND THORIUM ANALYSES OF BASIC AND ULTRA-BASIC ROCKS. J. F. Lovering and J. W. Morgan (Australian National Univ., Canberra). Nature, 199: 479-80(Aug. 3, 1963).

Data obtained using neutron activation and isotope dilution techniques for the determination of low levels of uranium and thorium in basic and ultra-basic rocks from 4 locations are compared. The samples represent materials forming the Earth's upper mantle. The significance of results with respect to the radioactive generation of heat in the upper mantle is discussed. (C.H.)

33828 A RAPID METHOD FOR ESTIMATION OF IODINE-131 IN MILK. H. Smith and E. L. Whitehead (United Kingdom Atomic Energy Authority, Annan, Dumfriesshire, Eng.). Nature, 199: 503-4(Aug. 3, 1963).

A pooled sample of milk from about 300 cows was subjected to ultrafiltration. Radiochemical analysis of the ultrafiltrate and residue indicated that 60% of the I^{131} was present in the ultrafiltrate. Samples of the original milk were then passed through an anion exchange resin column. Duplicate analysis showed 100% retention of I^{131} by the resin. It was concluded that I^{131} complexed with protein is quantitatively removed by resin treatment. Results are compared with those using standard radiochemical procedure. (C.H.)

33829 DETERMINATION OF SCANDIUM IN MINERALS AND SEA-WATER. Tsunenobu Shigematsu (Kyoto Univ.), Masayuki Tabushi, Yasuharu Nishikawa, Keizo Hiraki, Shiro Goda, and Reiko Inoue. Nippon Kagaku Zasshi, 84: 336-9(Apr. 1963). (In Japanese)

Scandium was determined in mineral and sea-water samples by a spectrophotometric method with 5,7-dichloroxine. The procedure is as follows: 0.5 to 1 g of mineral sample is treated with HF and dissolved in HCl. 100 to 200 mg of Ca^{2+} as a carrier and oxalic acid solution are added and pH of the solution is adjusted to 1.8. After standing overnight, the precipitate is ignited and the residue is dissolved in HCl. Sc is separated by extracting at pH 1.5 with 10 ml of 0.2 M TTA–benzene followed by back extracting with 20 ml of 1 N HCl. After Fe and other interfering elements are pre-extracted at pH 3 as 5,7-dichloroxinate, the Sc chelate is successively extracted at pH 9.5 with 10 ml of chloroform. Absorbances are measured at 397 mμ against the reagent blank. Sc in sea water is concentrated also by coprecipitating with Ca oxalate, using each 200 ml of 2 N oxalic acid for 20 l of sample. Several mineral samples such as bauxite, garnet, lepidolite, and fluorspar were analyzed, and a Sc content of 10^{-3} to 10^{-4}% was obtained. Sc in sea water collected at offshore Misaki-cho gave the order of 10^{-3} μg/l. (auth)

33830 RADIOACTIVE TRACERS IN ANALYTICAL CHEMISTRY. S. A. Reynolds and G. W. Leddicotte (Oak Ridge National Lab., Tenn.). Nucleonics, 21: No. 8, 128-42(Aug. 1963).

Tracers, techniques, and analytical methods are discussed; and typical inorganic and organic applications of radiotracers in analytical chemistry are listed. The tracers used, material or element determined, and method followed are given. 735 references. (D.C.W.)

33831 SELF-SHIELDING IN ACTIVATION ANALYSIS. J. Gilat and Y. Gurfinkel (Israel Atomic Energy Commission, Rehovoth). Nucleonics, 21: No. 8, 143-4(Aug. 1963).

An interpolation procedure that gives a good approximation of the self-shielding in neutron activation analysis of a target with a finite-cylinder geometry is described. Neutron scattering in the sample is shown to affect the self-shielding factor very little except for highly scattered samples. Calculated and experimental values for isotopic analysis of uranium agree rather well. (D.C.W.)

33832 8-ACETOXYQUINALDINE AS AN ANALYTICAL REAGENT. PRECIPITATION OF THORIUM. E. J. Billo, B. E. Robertson, and R. P. Graham (McMaster Univ., Hamilton, Ont.). Talanta, 10: 757-62(July 1963). (In English)

Thorium can be precipitated from homogeneous solution as the 1:4 chelate, $Th(C_{10}H_9ON)_4$, by 8-hydroxyquinaldine generated by the hydrolysis of 8-acetoxyquinaldine. The use of the ester yields a precipitate with physical characteristics distinctly superior to those of the precipitate produced in a conventional way by 8-hydroxyquinaldine, but purity is attained under somewhat more restrictive conditions. Reasons for this are discussed. (auth)

33833 DETERMINATION OF RHODIUM-103, NEODYMIUM-143, SAMARIUM-149 AND -151, AND GADOLINIUM-155 IN IRRADIATED URANIUM. M. Ward and J. K. Foreman (United Kingdom Atomic Energy Authority, Windscale, Sellafield, Cumb., Eng.). Talanta, 10: 779-85 (July 1963). (In English)

Methods for the determination of Rh^{103}, Nd^{143}, Sm^{149}, Sm^{151}, and Gd^{155} in irradiated uranium metal are described. The concentrations of the five isotopes were determined in a rod of uranium, which had received an irradiation of approximately 850 Mwd/t in a Calder reactor. Rh^{103} was determined colorimetrically following anion-exchange purification and the lanthanide isotopes by isotope dilution and mass spectrometry, again after ion-exchange purification. (auth)

33834 THE POTENTIAL USE OF THE ELECTRON-EXTRACTION METHOD FOR ANALYZING SOLID MATERIALS BY MEANS OF THE MASS SPECTROMETER. L. T. Duev. Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR, No. 11, 199-204(1962). (In Russian)

In order to be able to subject solid materials to mass spectrographic analysis, they must be first transformed into a gas, then into positive or negative ions. The electron extraction method, which involves the exposure of the sample to a beam of focused electrons accelerated to several ten thousand volts was used for this purpose. The electrons are slowed down in the metal, losing their kinetic energy by heating up the metal, thus causing a high rate of evaporation. The evaporated molecules and atoms are then ionized by low, 20 to 100-kev electrons; the resulting beam is directly used in the mass spectrograph. The temperature distribution within the metallic sample was calculated; the results showed that in some portions temperatures up to 1500°C may be reached, causing a strong evaporation of the metal. The calculations also showed that in practice the method may be useful with a mass spectrograph with a sensitivity not exceeding 10^{-14} Å. (TTT)

33835 THE EVAPORATION METHOD IN SPECTRAL ANALYSIS. A. N. Shteinberg. Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR, No. 11, 237-42(1962). (In Russian)

The rapid development of science and the use of new elements, especially in the atomic industry and the semiconductor technology, places a great emphasis on the purity of the materials, requiring analytical methods which are able to detect impurities in the 10^{-4} to 10^{-6}% range; the specifications are expected to become even more rigorous in the near future. The current sensitivity of emission spectroscopy which reaches to 10^{-4}%, is not sufficient. Radiation sources must be developed in order to separate weakly modulated signals from the continuous background. Another possibility involves the enrichment of a given component or impurity. The thermal distillation or evaporation method, originally developed by A. N. Zaidel' and S. L. Mandel'shtam, makes use of the differential volatility of the materials, separating them by fractional distillation. Depending on their relative stability, either the base metal or the impurity is driven off. Studies with radioactive isotopes allowed the "complete release" temperature for a given mixture to be determined. The heating of the material is carried out in a graphite crucible, and its temperature checked by means of an optical pyrometer. The condensing portion of system must be carefully constructed and leaks eliminated. Amounts of 50 to 100 mg are used for the analysis. The analyzed material must have a low volatility; this is taken care of in the choice of the chemical form; thus U, Th, Pu, Zr, Ta, Ti, rare earths, Ca, and Be are best used as oxides. (TTT)

33836 USE OF COMPLEXONES FOR COULOMETRIC TITRATION OF THORIUM. I. A. Tserkovnitskaya and Ju-Chin Eey (Leningrad State Univ.). Zh. Analit. Khim., 18: 822-8(July 1963). (In Russian)

The possibility was established for thorium coulometric titration by means of ethylenediaminetetraacetic acid. Iron(III), copper, and mercury ethylenediaminetetraacetates

can be used for the determination of the thorium content. The advantage of mercury ethylenediaminetetraacetate for the determination of about 0.1 mg or more of thorium in 20 ml is discussed. (auth)

33837 DETERMINATION OF ZIRCONIUM AND HAFNIUM WHEN PRESENT TOGETHER BY THEIR CATALYTIC ACTION. K. B. Yatsimirskii and L. P. Raizman. Zh. Analit. Khim., 18: 829-34(July 1963). (In Russian)

A study was made of the relation between the rate of the catalytic reaction of iodide oxidation with hydrogen peroxide in an acid medium in the presence of zirconium and hafnium salts and the pH of the solutions. It was found that the maximum catalytic activity is at pH 1.1 for zirconium and at pH 2.2 for hafnium. It was established that when zirconium and hafnium are present together in the solution their effect on the rate of the catalytic reaction is an additive one. A kinetic method is suggested for the analysis of mixtures in solutions containing zirconium and hafnium. (auth)

33838 CERTAIN DERIVATIVES OF DITHIOCARBAMIC ACID AS REAGENTS FOR NIOBIUM. I. M. Gibalo, I. P. Alimarin, and P. Davaadorzh (Moscow State Univ.). Zh. Analit. Khim., 18: 835-9(July 1963). (In Russian)

A number of derivatives of dithiocarbamic acid (ammonium pyrrolidinedithiocarbaminate, sodium piperidinedithiocarbaminate, ammonium phenylhydrazinedithiocarbaminate, and sodium diethyldithiocarbaminate) have been studied as reagents for niobium. It was established that the best reagent is ammonium pyrrolidinedithiocarbaminate. Conditions were studied for niobium pyrrolidinedithiocarbaminate extraction from tartaric, citric, and oxalic acid solutions. It was found that niobium pyrrolidinedithiocarbaminate can be quantitatively extracted with chloroform from concentrated hydrochloric acid solutions (8–10 N HCl), as well as from tartaric and oxalic acid solutions at pH 4–5. Conditions for back extraction of niobium from the organic phase are given. (auth)

33839 GRAVIMETRIC DETERMINATION OF PLATINUM, PALLADIUM, RUTHENIUM, RHODIUM AS $TlPtS_3$, $TlPd_2S_3$, $TlRu_2S_6$, $TlRh_2S_4$. N. A. Rudnev and G. I. Malofeeva (Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Analit. Khim., 18: 859-64(July 1963). (In Russian)

Gravimetric methods were developed for the determination of microamounts of Ru, Rh, Pt, and Pd as $TlRu_2S_6$, $TlRh_2S_4$, $TlPtS_3$, and $TlPd_2S_3$. The methods are simple, rapid, and satisfactorily accurate. (auth)

33840 RADIOACTIVATION METHOD FOR DETERMINING OXYGEN IN SOME POLYMERS. L. V. Chepel, B. A. Chapyzhnikov, and B. I. Viting (Inst. of Physical Chemistry, Moscow). Zh. Analit. Khim., 18: 865-72(July 1963). (In Russian)

A radioactivation method for determining oxygen in some polymers was developed, based on using the photonuclear reaction $O^{16}(\gamma,n)O^{15}$. The accuracy of the method is 1–2% (relative). (auth)

33841 DETERMINATION OF BERYLLIUM HYDROXYFLUORIDE AND HYDROXYCHLORIDE IN BERYLLIUM FLUORIDE AND CHLORIDE. E. N. Deichman. Zh. Analit. Khim., 18: 903-4(July 1963). (In Russian)

A titrimetric method was developed for the determination of beryllium hydroxyfluoride and hydroxychloride in beryllium fluoride and chloride by titrating their solutions in the presence of phenol red after adding the sodium fluoride excess. (auth)

33842 ANALYSIS INSTRUMENTATION — 1963. Proceedings of the Ninth National Analysis Instrumentation Symposium held April 29-May 1, 1963, at Houston, Texas. L. Fowler, R. D. Eanes, and T. J. Kehoe, eds. New York, Plenum Press, 1963. 267p. $12.50.

Fifty-one papers are included on the status, dynamics, and problems of analytical instrumentation; laboratory instrumentation; electrochemical and chemical methods; and radiation methods of analysis. Separate abstracts were prepared for four papers. (D.E.B.)

33843 AN INEXPENSIVE ELECTRICAL CONDUCTIVITY SYSTEM FOR DYNAMIC TESTING. William C. Clements, Jr. and Karl B. Schnelle, Jr. (Vanderbilt Univ., Nashville). p.53-63 of "Analysis Instrumentation — 1963." New York, Plenum Press, 1963.

Electrolytic conductivity is defined, and available commercial conductivity measuring apparatus is discussed. A design for an inexpensive amplified electrical conductivity bridge whose static and dynamic characteristics were determined is presented. The bridge features include a variable null point and a stable output whose frequency response is flat out to about 3 cps. The construction of platinum conductivity cells is discussed. Both flow cells and dip cells were prepared. The method used for platinizing the cells is reviewed. The bridge was used to conduct pulse tests of mixer-settler extraction apparatus and continuous flow empty and packed columns. Recording was highly satisfactory. The bridge is adaptable to devices other than electrical conductivity where carrier circuits are used. (auth)

33844 INTEGRATED DESIGN APPROACH FOR A GAMMA-RAY DENSITY GAUGE. Philip T. Martin (Industrial Nucleonics Corp., Columbus, Ohio). p.219-27 of "Analysis Instrumentation — 1963." New York, Plenum Press, 1963.

A technique for determining gage performance is presented. Design parameters, techniques for adjusting them, and their effect on performance are discussed. Development of an existing design and the achievement of design objectives are reviewed. (auth)

33845 NEUTRON METHODS FOR LUNAR AND PLANETARY SURFACE COMPOSITIONAL STUDIES. J. I. Trombka and A. E. Metzger (California Inst. of Tech., Pasadena). p.237-50 of "Analysis Instrumentation — 1963." New York, Plenum Press, 1963.

The requirements and state-of-the-art of instruments using a neutron source and gamma ray scintillation spectrometer as detector, which might be used on a lunar or planetary soft landing mission, are discussed. The composition of the surface is to be inferred from a measurement of the characteristic gamma ray pulse height spectra produced by neutron activation, neutron capture, and inelastically scattered neutrons. (auth)

33846 QUANTITATIVE ANALYSIS BY CHARGED PARTICLE BOMBARDMENT. R. S. Sippel. p.251-60 of "Analysis Instrumentation — 1963." New York, Plenum Press, 1963.

The advantages and limitations of the charged particle methods of analysis are discussed and illustrated by data obtained in the Socony Mobil Field Research Laboratory, Dallas, Texas. (auth)

33847 AUTOMATIC COULOMETRIC TITRATOR (Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE-785)

This package contains 6 drawings. The electronic instrument is used for coulometric Redox titrations at controlled

potentials. The potential of the electrode at which the reaction occurs is controlled by a stabilized difference amplifier combined with a transistor current amplifier. The electrolysis current is integrated by a stabilized amplifier and the integral is read out as a voltage. Manual and automatic titrations may be made. The instrument, which is an alternating current line-operated type, is very stable and gives results of good precision which are obtained by calculation from Faraday's law. (F.E.S.)

33848 DETERMINATION OF SULPHUR CONTENT OF HYDROCARBONS BY BREMSSTRAHLUNG ABSORPTION MEASUREMENT. T. B. Rowley. 10p. (CONF-5-1).

From British IRE Convention on Electronics and Productivity, Southampton, Eng., Apr. 1963.

The parameters affecting the design and choice of components for equipment using bremsstrahlung absorption measurements to determine sulfur content of hydrocarbons are discussed. The operational requirements and general design of the equipment are outlined. The choice of radioactive source, construction of flow cell, radiation detectors, and circuitry is considered. Accuracy of the measurements and possible sources of error are also discussed. (C.E.S.)

33849 ACTIVATION ANALYSIS APPLIED TO STEEL PRODUCTION. G. I. Crawford, A. L. Gray, and G. D. Smith. 14p. (CONF-5-2)

From British IRE Convention on Electronics and Productivity, Southampton, Eng., Apr. 1963.

The techniques of neutron activation analysis were discussed, as applied to steel production, and equipment suitable for this application was described. It is believed that these techniques may offer the possibility of direct process control, since the analyses can be performed automatically and the results are presented in a form that could easily be applied to a controlling mechanism. (auth)

33850 ISOTOPIC ANALYSES WITH A SPARK SOURCE MASS SPECTROGRAPH. F. D. Leipziger (Sperry Rand Research Center, Sudbury, Mass.). 5p. (CONF-74-11)

From Conference on Mass Spectrometry and Allied Topics, San Francisco, May 1963.

Problems arising from the use of the spark source and the photographic detector, and the minimization of their consequences, are discussed. Results of analyses showing the suitability of the instrument for isotope dilution analyses, establishment of upper limits of isotopic abundance, and dating of uranium bearing minerals are included. (D.C.W.)

33851 USE OF THERMAL NEUTRON ACTIVATION ANALYSIS FOR LUNAR SURFACE COMPOSITIONAL ANALYSIS. J. W. Haffner (Illinois Inst. of Tech., Chicago). 17p. (CONF-39-75)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Samples of three meteorites and two terrestrial rocks were weighed and encapsulated in the same manner. Each of the 5 samples and a dozen standards were irradiated with 6×10^{11} neutrons/cm^2 sec for 10 sec, allowed to decay for 2 min, and counted for 2 min. The samples were also counted 15 and 194 min after irradiation. The results of the analyses showed Al, Mg, Fe, Mn, Na, Ni, and Si present in the meteorite samples and Al, Mg, Fe, Mn, and Na present in the rocks. (P.C.H.)

33852 PROMPT ACTIVATION ANALYSIS FOR BORON AND LITHIUM. Lincoln Clark, Jr. and N. C. Rasmussen (Massachusetts Inst. of Tech., Cambridge). 38p. (CONF-39-81)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Successful measurements were made of boron and lithium present in trace amounts in aluminum for concentrations down to 5 ppm, and it is believed that the method is reasonably accurate for concentrations a factor of 10 below this, as a result of measurements made on samples of aluminum and graphite containing low, but unknown, amounts of boron and lithium. Measurements made on samples of aluminum and graphite wrapped in cadmium, to simulate the effect of materials with still lower boron and lithium contents, indicate that the method should be practical at least down to levels of 0.05 ppm boron or lithium. Even at a flux level of 10^8 n/cm^2-sec, the count rates are reasonably high compared to background, and it is possible that they could be increased by utilizing a higher flux level before the pileup of beta pulses places a limit on the sensitivity of the system. (P.C.H.)

33853 NEUTRON ACTIVATION ANALYSIS OF NUCLEAR MATERIALS. F. Girardi and J. Pauly (Euratom, Ispra, Italy). 18p. (CONF-140-1; EUR 306.i). (In Italian)

From Nuclear Energy Conference, Milan, Dec. 1961.

Neutron activation analysis was adopted for the detection of impurity traces in various materials intended for use in nuclear industry. For metals, a method was devised for the systematic separation of impurities which, after irradiation, will give rise to long-lived activities. The technique was applied to aluminum: after irradiation in the Ispra I reactor, the metal is dissolved in hydrochloric acid, the excess aluminum then being precipitated in the form of trichloride and the impurities removed by means of ion-exchanger resins and other chemical processes. An automatic apparatus was built for the subsequent elutions. In various organic substances (terphenyls and plastics) the elements that generate short-lived activities are determined by irradiating for a few minutes and then tracking by gamma-spectrometry the decay of the characteristic gamma rays. The long-lived radioelements can be analyzed only after destruction of the organic phase and subsequent systematic chemical separation by precipitation with H_2S and NH_3 after addition of carriers. (auth)

33854 PROCESS FOR THE TREATMENT OF AN ORGANIC SOLVENT CONTAINING URANIUM. Harold Mason, James Roland Sanderson, and Tony Mason (to United Kingdom Atomic Energy Authority). U. S. Patent 3,099,537. July 30, 1963. Priority date Oct. 31, 1957, Great Britain.

A process for the treatment of an organic solvent containing uranium comprises the steps of washing the solvent with an aqueous solution of a colorimetric agent for uranium to bring all the uranium into the aqueous solution, treating at least part of the colored solution with a decolorizing agent for the coloration due to uranium only, and measuring the difference between color intensity before and after treatment. The difference in color intensity is a measure of the uranium concentration. A preferred colorimetric agent is ammonium thioglycollate, which converts any uranium to uranium thioglycollate having an intense yellow color. (C.E.S.)

33855 COMBINED ELECTRON PROBE MICROANALYZER AND X-RAY DIFFRACTION INSTRUMENT. Takeo Ichinokawa. U. S. Patent 3,099,743. July 30, 1963. Priority date July 7, 1961, Japan.

An electron probe microanalyzer that can be remotely converted for use as an x-ray diffraction instrument is presented. The elements in a microportion of sample can

be determined as well as the crystalline structure, azimuth, and orientation. The electron source, lens system, specimen, photographic plates, and conversion and adjustment apparatus are enclosed within a vacuum chamber. (C.E.S.)

Inorganic and Physical Chemistry

33856 (AERE-R-3565(Rev.)) APPARATUS FOR THE MEASUREMENT OF VAPOUR PRESSURES OF AQUEOUS SOLUTIONS AT HIGH TEMPERATURES. H. J. de Nordwall and P. J. Jones (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Apr. 1961. Revised July 1963. 44p.

An apparatus for measuring the vapor-pressure-lowering of aqueous solutions in the temperature range 100 to 250°C is described. A brief review of methods of measuring pressure differences in chemical systems is given as an introduction to the description of the apparatus. (auth)

33857 (AFCRL-63-192) PROPERTIES OF RARE EARTH AND TRANSITION GROUP IONS. B. Bleaney (Oxford Univ. Clarendon Lab.). Apr. 4, 1963. Contract AF61(052)-125. 205p.

Single-crystal and other specimens of rare-earth compounds including trihalides and garnets were prepared. Their magnetic properties were investigated by EPR, NMR, magnetic relaxation, magnetic susceptibility, and specific heat measurements. (auth)

33858 (ANL-6747) TABLES OF OXYGEN PRESSURES CALCULATED FROM THE HYDROGEN–WATER SYSTEM AND FROM THE DISSOCIATION OF CUPRIC OXIDE. L. M. Atlas and J. B. Moser (Argonne National Lab., Ill.). July 1963. Contract W-31-109-eng-38. 9p.

The dissociation of various mixtures of hydrogen and water vapor and of cupric oxide was calculated over a wide range of temperatures (from 600 to 1700°C for the H_2-H_2O system, and from 200 to 1000°C for CuO). The resulting partial pressures of oxygen are presented in tabular form. (auth)

33859 (ARF-2208-16) DIFFUSION IN TITANIUM AND TITANIUM ALLOYS. Final Report. Rodney P. Elliott (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Mar. 1962. Contract AF33(616)-7656. 64p. (ASD-TDR-62-561; AD-290336)

The self-diffusion of titanium and the interdiffusion of aluminum, zirconium, molybdenum, vanadium, and oxygen in titanium were investigated in the temperature range 600 to 1300°C. Diffusion couples were prepared by roll-bonding or press-bonding techniques. Electron microprobe methods were used to determine the penetration of the substitutionally dissolved solutes; vacuum fusion analysis was used to determine the penetration of interstitially dissolved oxygen. The determined diffusion may be summarized: $\ln D_T = (-27.14 \pm 1.56) - (11{,}800 \pm 3{,}000)/RT$ for Zr in α-Ti. $\ln D_T = (-4.01 \pm 1.22) - (40{,}100 \pm 3{,}300)/RT$ for Zr in β-Ti. $\ln D_T = (-17.19) - (28{,}400)/RT$ for Mo in α-Ti. $\ln D_T = (-9.00 \pm 0.92) - (33{,}100 \pm 2{,}400)/RT$ for Mo in β-Ti. $\ln D_T = (-31.39) - (3{,}100)/RT$ for V in α-Ti. $\ln D_T = (-4.38 \pm 1.04) - (41{,}400 \pm 2{,}800)/RT$ for V in β-Ti. $\ln D_T = (-14.94 \pm 1.15) - (16{,}200 \pm 2{,}200)/RT$ for O in α-Ti. $\ln D_T = (+8.37 \pm 2.21) - (66{,}800 \pm 7{,}000)/RT$ for O in β-Ti. The electron microprobe analysis could not be used to determine the penetration curves of aluminum in titanium because of the very high absorption of characteristic aluminum x radiation by titanium. The self-diffusion of titanium was investigated by studying penetration of Ti^{44}, formed by bombarding scandium with protons. Diffusion couples were formed by dissolving Ti^{44}-enriched TiO_2 into the titanium. Self-diffusion of titanium may be summarized: $\ln D_T = (-21.08) - (5{,}700)/RT$ for α-Ti. $\ln D_T = (-8.40) - (28{,}600)/RT$ for β-Ti. The diffusion equations for molybdenum and vanadium in α-titanium, and for the self-diffusion of titanium must be considered preliminary. (auth)

33860 (BNL-6638) BROMINE EXCHANGE IN GRAPHITE–BROMINE LAMELLAR COMPOUNDS. Seymour Aronson (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-Gen-16]. 30p. (CONF-73-7)

From Conference on Carbon, Pittsburgh, June 1963.

A kinetic study of the exchange of normal and radioactive bromine in graphite-bromine lamellar compounds was made at temperatures of 30 to 50°C. Natural and synthetic graphite powders were investigated. Two alternative mechanisms for the exchange, volume diffusion and surface exchange, were considered. The data are in better agreement with the diffusion mechanism. Diffusion coefficients of 10^{-9} to 10^{-8} cm^2/sec and an activation energy of 11 to 14 kcal/mole were calculated for the natural graphite powders. The diffusion coefficients increased with increasing bromine content. Reversibly absorbed bromine exchanged more rapidly than irreversibly absorbed bromine. (auth)

33861 (CONF-20-18) X-RAY CRYSTALLOGRAPHIC STUDIES OF EUROPIUM OXIDES AND HYDROXIDES. Robert C. Rau (General Electric Co. Advanced Technology Services, Cincinnati). [1962]. Contract [AT(40-1)-2847]. 11p. (TM-63-2-8)

X-ray-diffraction methods were employed to study the phases occurring in the europium–oxygen system and in the europium hydroxide decomposition process. Europium sesquioxide, Eu_2O_3, containing trivalent europium ions, occurs in two forms, body-centered cubic and monoclinic. Divalent europium forms a monoxide, EuO, which is face-centered cubic. Both divalent and trivalent ions are combined in the compound Eu_3O_4, which is orthorhombic. Another orthorhombic compound of unknown composition was obtained which is also believed to contain divalent and trivalent ions. Studies on the thermal decomposition of europium hydroxide to the sesquioxide yielded data on two hydroxide phases. The starting material, $Eu(OH)_3$, is hexagonal and decomposes into an intermediate phase, EuOOH, which is believed to be orthorhombic. (auth)

33862 (CONF-39-50) THE THERMAL EXPANSION AND HEAT CAPACITY OF UO_2 TO 2200°C. J. B. Conway, R. M. Fincel, Jr., and R. A. Hein (General Electric Co. Advanced Technology Services, Cincinnati). [nd]. Contract [AT(11-1)-171] 24p. (TM-63-6-6).

From American Nuclear Society Meeting, Salt Lake City, June 1963.

Measurements of the enthalpy and heat capacity of UO_2 in the temperature range of 900 to 2200°C were made by employing the drop technique in conjunction with an adiabatic calorimeter. The following heat capacity relationship was obtained: $Cp = 7.919 \times 10^{-2} - 19.468 \times 10^{-6}T + 15.09 \times 10^{-9}T^2$, where Cp is in cal/g°C and T is in °C. The linear thermal expansion of UO_2 was measured by sighting paired filar micrometer telescopes on fiducial marks on either end of a 0.25-in. dia, 2.5-in. long specimen. The equation for the coefficient of linear thermal expansion is $\alpha(in./in.\ °C) = 6.797 \times 10^{-6} + 5.792 \times 10^{-9}T$. Data are presented in graphs. (M.C.G.)

33863 (CONF-126-1) FLUORIDES OF XENON—PREPARATION AND PROPERTIES. Cedric L. Chernick

(Argonne National Lab., Ill.). [1963]. Contract [W-31-109-eng-38]. 9p.

From Conference on Noble Gas Compounds, Argonne, Ill., April 1963.

A review is given of the methods used for preparing the three Xe fluorides, XeF_2, XeF_4, and XeF_6. The methods are also tabulated. The properties of each fluoride are described briefly. A bibliography of 15 references is given. (D.L.C.)

33864 (CONF-126-7) THERMOCHEMICAL STUDIES OF XeF_4 AND XeF_6. L. Stein and P. Plurien (Argonne National Lab., Ill.). [1963]. Contract W-31-109-eng-38. 11p.

From Conference on Noble Gas Compounds, Argonne, Ill., Apr. 1963.

The reduction of XeF_4 and XeF_6 with hydrogen was studied with an isothermal calorimeter at 120 to 130°C. Each compound reacts rapidly with hydrogen in this temperature region, forming xenon and hydrogen fluoride: $XeF_4(g) + 2H_2(g) \rightarrow Xe(g) + 4HF(g)$ and $XeF_6(g) + 3H_2(g) \rightarrow Xe(g) + 6HF(g)$. Preliminary values of the heats of reaction obtained thus far are $\Delta H = -202$ and -306 kcal/mole for the first and second reaction, respectively. The approximate heats of formation are calculated to be: -55 and -79 kcal/mole, respectively. From the present measurements the average xenon-fluorine bond energy is found to be 32.0 kcal in the tetrafluoride and 31.5 kcal in the hexafluoride. (auth)

33865 (CONF-126-9) VIBRATIONAL SPECTRA AND STRUCTURES OF XeF_4 AND $XeOF_4$. Howard H. Claassen, Cedric L. Chernick, and John G. Malm (Argonne National Lab., Ill.). [1963]. Contract W-31-109-eng-38. 22p.

From Conference on Noble Gas Compounds, Argonne, Ill., Apr. 1963.

The infrared spectrum of XeF_4 vapor has strong bands at 123, 291, and 586 cm^{-1}. The Raman spectrum of the solid has very intense peaks at 502 and 543 cm^{-1} and a weaker one at 235 cm^{-1}. These data show that the molecule is planar and of symmetry D_{4h}. The seven fundamental frequencies were assigned as 543 (a_{1g}), 291 (a_{2u}), 235 (b_{1g}), 221 (b_{1u}), 502 (b_{2g}), 586 (e_u), and 123 (e_u), the assignment of 221 cm^{-1} to b_{1u} being uncertain. The infrared spectrum of $XeOF_4$ vapor has intense peaks at 288, 362, 578, 609, and 928.2 cm^{-1} and the Raman spectrum of the liquid has bands at 231, 286, 364, 530, 566, and 918 cm^{-1}. The spectra fit a C_{4v} model very well. The fundamentals determined are: 928.2 (a_1), 578 (a_1), 288 (a_1), 231 (b_1), 530 (b_2), 609 (e), and 362 (e). This leaves one (b_2) and one (e) fundamental undetermined. Very close correspondence between vibrations in the two molecules indicates that the O–Xe–F angle in $XeOF_4$ must be rather close to 90°. (auth)

33866 (CONF-126-10) RADON FLUORIDE; FURTHER TRACER EXPERIMENTS WITH RADON. P. R. Fields, L. Stein, and M. H. Zirin (Argonne National Lab., Ill.). [1962]. Contract W-31-109-eng-38. 21p.

From Conference on Noble Gas Compounds, Argonne, Ill., Apr. 1963.

It was shown in tracer experiments that radon fluoride can be prepared by heating mixtures of radon and fluorine to 400°C. The compound is very stable and distills at 230 to 250° at a pressure of approximately 10^{-6} mm Hg. It can be reduced with hydrogen at 500° to recover elemental radon. Attempts to prepare a radon chloride by thermal and photochemical methods were unsuccessful thus far. No chemical reactions were detected in mixtures of radon and oxygen irradiated with ultra-violet light or passed through a Berthelot type ozone generator. However, it was observed that the high-voltage electrical discharge used to produce ozone causes some radon to be strongly fixed on Pyrex surfaces. Microwave discharges were also found to be very effective in fixing radon on quartz and Pyrex. In experiments with a metal microwave cell, radon was fixed on a central brass antenna and subsequently released by heating the brass to the softening point (~ 900°). (auth)

33867 (CONF-151-2) VARIATION OF THE HALF-WAVE POTENTIAL OF ORGANIC COMPOUNDS WITH pH. Report No. 78. Philip J. Elving (Michigan. Univ., Ann Arbor. Dept. of Chemistry). June 21, 1963. Contract AT(11-1)-1148. 73p.

From 19th International Union of Pure and Applied Chemistry Congress, London.

A systematic introduction is presented to the subject of the variation with pH of the polarographic half-wave potential, which is probably the most readily measured electrochemical energetic parameter of organic compounds. Emphasis is placed on (a) the types of relationships observed for both reversible and irreversible electrode processes, (b) the mathematical formulation of these relationships, (c) the structural, mechanistic, kinetic, and environmental factors influencing such relationships, and (d) the presumptive physical causes for such relationships, e.g., the effect of pH on the electrochemical kinetics. Although the discussion is primarily concerned with behavior in aqueous solution, the conclusions drawn are equally valid for nonaqueous media in which hydrogen ion or some other Lewis acid can play a significant role. The half-wave potential for an organic electrode process may be independent of pH, or may vary linearly or sigmoidally; other types of relationships observed are likely to be combinations of such effects. These variations may be due (a) to direct participation of hydrogen ion in the transition state involving the electroactive site in the organic molecule and the electron source, e.g., polarization of the bond to be broken, (b) to control of the state of reactants and/or products via participation in pre- and postequilibria, e.g., acid-base equilibria affecting the nature of the reactant or (c) to the effects of other kinetic, adsorption, steric, hydrogen-bonding and electrical double layer phenomena, as well as to combinations and variations of these effects. Solution composition factors influencing the observed variation of half-wave potential with pH include the ionic strength, the nature of the solvent, the specific identity of buffer components, and nonspecific salt effects. The implications of the experimentally observed half-wave potential-pH relations are considered in respect to the development of analytical procedures and the correlation of half-wave potential data. (auth)

33868 (CONF-154-1) VISCOSITY OF CONCENTRATED SUSPENSIONS OF SPHERICAL PARTICLES. Harold L. Weissberg (Oak Ridge Gaseous Diffusion Plant, Tenn.) and Stephen Prager (Minnesota. Univ., Minneapolis). [1963]. Contract [W-7405-eng-26]. 3p.

From the 4th International Congress of Rheology, Providence, R. I., Aug. 1963.

Hashin and Prager derived a lower bound for the apparent viscosity of a suspension, using variational methods, but the bound is not applicable to a random medium. An alternative method is used to introduce the random geometry. The integrals for concentrated suspensions are evaluated directly by removing the no-overlap restriction, and an equation is derived for the bound: $\eta^* > (\eta/\phi)(1 - 1.5 \ln\phi)$, where ϕ = volume fraction of liquid. (D.L.C.)

33869 (IFA/IS/20) SIMULTANEOUS ISOTOPIC EXCHANGE AND CATALYTIC OXIDATION OF HYDROGEN

REACTIONS ON NICKEL–CHROMIA. D. Barb, I. Ursu, M. Bologa, and M. Razvantă (Academia R.P.R. Institutul de Fizică Atomică, Bucharest). Nov. 29, 1962. 13p.

Data were obtained on the simultaneous isotopic exchange and catalytic oxidation of the hydrogen reactions on nickel-chromia. It was concluded that the isotope exchange and catalytic oxidation reactions may be produced simultaneously over nickel–chromia catalyst. A steady equilibrium was established between these two reactions. At up to 4 to 5% oxygen there was no influence of oxidation on the isotopic exchange reaction. At oxygen contents greater than 4 to 5% there was influence of oxidation. (M.C.G.)

33870 (IS-621) COMPLEX SYSTEMS OF THE RARE EARTH METALS WITH GLYCOLATE, LACTATE AND α-HYDROXYISOBUTYRATE LIGANDS. J. E. Powell, R. H. Karraker, R. S. Kolat, and J. L. Farrell (Ames Lab., Ames, Iowa). [Feb. 12, 1963]. Contract [W-7405-eng-82]. 12p. (CONF-20-6)

From Rare Earth Conference, Clearwater, Fla., Apr. 1963.

The stability constants for the reaction of the trivalent rare earth metal ions with glycolate, lactate, and α-hydroxyisobutyrate ligands have been determined. A potentiometric measurement of the hydrogen ion concentrations of solutions containing varying amounts of the ligands was used to determine these constants. The ionic strength of the solutions was adjusted to 0.10 with sodium perchlorate and the constants were measured at 20°. The order of stabilities was found to be glycolate < lactate < α-hydroxyisobutyrate. The solid, hydrated triglycolates, trilactates, and tri-α-hydroxyisobutyrates of the rare earths and yttrium were prepared, analyzed, and thermally decomposed on a recording balance to determine the normal degree of hydration of the solid chelates. From aqueous solution the glycolates of the light rare earths, lanthanum through europium, were found to separate in anhydrous form only; whereas, the glycolates of the heavy rare earths, gadolinium through lutetium, were obtained as dihydrates. From a warm solution gadolinium glycolate was also obtained in the anhydrous form. All of the lactates prepared (neodymium through lutetium) were obtained as trihydrates, but the rare earth α-hydroxyisobutyrates contained from 3 to 7 moles of water (from cerium through neodymium the hydration number was 3, from samarium through gadolinium the number was 5, and from terbium through lutetium and in the case of yttrium the number was 6). Lanthanum α-hydroxyisobutyrate alone exhibited an "as prepared" hydration number of seven. Thermal decomposition of the hydrated rare earth lactates and α-hydroxyisobutyrates yielded both dihydrated and anhydrous compounds in most instances, although a few monohydrated compounds were observed in the α-hydroxyisobutyrate series. The solubilities of the individual rare earth lactates and α-hydroxyisobutyrates in water at 20 and 60° were determined for comparison with the rare earth glycolate solubilities determined earlier. (auth)

33871 (NP-13017) SIMULTANEOUS ISOTOPIC EXCHANGE AND CATALYTIC OXIDATION OF HYDROGEN REACTIONS ON PLATINUM–CARBON. I. Ursu, D. Strugarud, and M. Paladi (Academia R.P.R. Institutul de Fizica Atomica, Bucharest). May 1963. 8p.

Experimental data were obtained for hydrogen–deuterium exchange in the presence of oxygen on platinum–carbon catalyst. The isotopic exchange of hydrogen–water and the catalytic oxidation of hydrogen reactions could be produced simultaneously over platinum–carbon catalyst. A steady equilibrium between these two reactions was established. The determination of the velocity constant for hydrogen–deuterium exchange in the presence of oxygen proved that at a given concentration the oxygen acts as a poison for catalytic isotopic exchange. (M.C.G.)

33872 (ORNL-3391) MIXTURES OF METALS WITH MOLTEN SALTS. M. A. Bredig (Oak Ridge National Lab., Tenn.). Aug. 15, 1963. Contract W-7405-eng-26. 61p.

A review is presented of various types of solutions of metals in molten salts, especially in their own molten halides. With relatively little reference to the older literature, the progress made in the last 20 years is discussed. Roughly, the solutions are classified into two groups: The metal may retain, to some degree, its metallic properties in the solution, or it may lose them through strong interaction with the salt solvent. The alkali-metal systems are typical examples of the former type, while solutions of cadmium or bismuth represent the second. Equilibrium phase diagram data are presented in detail for many metal-salt systems. These include critical solution temperatures, that is, temperatures above which metal and salt are miscible in all proportions. Electrical conductivity is singled out as a most significant physical property from which conclusions on the state of the electron in the solution may be drawn. In the electronically conducting solutions, notably of the alkali metals, the electrons may be thought to resemble F centers in color-center colored crystals. In solutions where electronic conductance is absent, monomeric, dimeric, and even more highly polymerized species of the solute metal in a low valence state must be assumed to occur. (auth)

33873 (TID-19236) THE APPLICABILITY OF THE DEBYE MODEL TO THERMAL CONDUCTIVITY. Report No. 124. R. O. Pohl (Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics). July 1, 1963. Contract [AT(30-1)-2179]. 28p.

The thermal conductivity of KBr crystals containing known concentrations of KNO_2 is studied at low temperatures. The conductivity of the doped crystals is greatly reduced and can be described with a simple relaxation time using the model of the thermal conductivity proposed by Debye. Crystals of KBr containing small concentrations of KI show a decrease in thermal conductivity very similar to that observed in mixed crystals with KCl as host lattice. This observation supports the model proposed by Wagner that quasi localized modes act as phonon scatterers. 35 references. (auth)

33874 (UCRL-10619) PRINCIPLES OF HIGH TEMPERATURE CHEMISTRY. Leo Brewer (California. Univ., Berkeley. Lawrence Radiation Lab.). June 1963. Contract W-7405-eng-48. 72p. (CONF-118-1)

From Robert A. Welsh Foundation Conference, Houston, Tex., Nov. 1962.

The general principles which characterize chemical behavior at high temperature and distinguish it from the normal type of chemistry are examined. The major problems of high temperature chemistry are indicated along with some of the techniques that are needed for solving these problems. The problem of equilibrium between a condensed phase and a gaseous phase at high temperature is discussed. (N.W.R.)

33875 (AEC-tr-5937) HETEROGENEOUS ISOTOPIC EXCHANGE. I. THE EXCHANGE OF Fe_3O_4 WITH Fe^{59}. K. Egger. Translated by Hal H. Stone (Oak Ridge National Lab., Tenn.) from Helv. Chim. Acta, 46: 1339-60(1963). 26p.

The isotopic ion exchange between various forms of Fe^{59}-labeled synthetic Fe_3O_4 and $FeCl_2$ solution was investigated from 9 to 95°C by measuring the activity of the solution

after various reaction times. The observed exchange rate was compared with the theoretically calculated rate for a diffusion-controlled reaction. The mathematics of the heterogeneous isotopic ion exchange is discussed. For short times a deviation from the $y/\sqrt{t}$ relationship was observed and attributed to an initial process superimposed on the diffusion reaction. This initial process probably consists of a rapid exchange of the solution with the first atomic layer of the solid. Diffusion coefficients (D_s) can be estimated from the slope of the straight line in the $y/\sqrt{t}$ plot. From the temperature dependence of the D_s-values the activation energy was calculated to be about 7 kcal/mole, and the self-diffusion coefficient (D_0) of Fe in Fe_3O_4 was estimated to be $5 \pm 3 \times 10^{-6}$ cm^2 sec^{-1}. (auth)

33876 (CEA-tr-A-1303) LA SÉPARATION EN CONTINU DE MÉLANGES D'IONS EN SOLUTION AQUEUSE PAR MIGRATION ELECTROLYTIQUE A CONTRE-COURANT. I. SÉPARATION D'IONS ISOTOPES ET MOLÉCULAIRES. (Continuous Separation of Mixtures of Ions in Aqueous Solution by Countercurrent Electromigration. I. Separation of Isotopic and Molecular Ions). K. Wagener. Translated into French from Z. Elektrochem., 64: 922-9(1960). 40p. (Includes original, 8p.).

Several methods for counter-current electrolytic separation of isotopic molecular ions in aqueous solutions are outlined. Factors affecting the migration rates of isotopes having different masses are derived. (T.F.H.)

33877 X-RAY POWDER DIFFRACTION STUDIES OF YI_3. B. H. Krause, A. B. Hook, and F. Wawner (Army Engineer Research and Development Labs., Fort Belvoir, Va.). Acta Cryst., 16: 848(Aug. 10, 1963). (In English)

A white salt, yttrium triiodide, prepared by heating high-purity yttrium metal in an excess of iodine vapor was flame-sealed in quartz capillaries. Powder-diffraction photographs were taken with CuKα radiation, and the pattern was compared with that of other triiodides. Interference patterns are shown pictorially. The lattice constants for the hexagonal unit cell at 20°C are a = 7.503 ± 0.008 Å and c = 20.81 ± 0.02 Å. The corresponding x-ray density is 4.617 g/cm^3. (R.E.U.)

33878 THERMOGRAVIMETRIC STUDY OF LANTHANUM, PRASEODYMIUM AND NEODYMIUM PICOLINATES AND DIPICOLINATES. Laurent Moyne and Germaine Thomas (Faculté des Sciences, Lyon). Anal. Chim. Acta, 29: 66-9(July 1963). (In French)

The crystallized products of La, Pr, and Nd picolinates and dipicolinates were studied and their thermal decomposition was followed by thermogravimetric analysis. The composition of the anhydrous precipitates of the picolinates corresponded to the formula $Ln(C_6H_4O_2N)_3$. The dipicolinates obtained at pH 6 have the formula $Ln_2(C_7H_3O_4)_3 \cdot 8H_2O$. The thermal decomposition of all the compounds studied led to the corresponding oxide, while forming a dioxymonocarbonate Ln_2O_3, CO_2 as an intermediate. (Ln = La, Pr, or Nd.) Results of the thermogravimetric analysis are tabulated. (P.C.H.)

33879 COMPLEX FORMATION AND FLUORESCENCE. PART III. SALICYLATE COMPLEXES. John A. Bishop (Newark Coll. of Engineering, N. J.). Anal. Chim. Acta, 29: 84-7(July 1963). (In English)

Studies were made on the effects of cations, Cu(II), Co(II), Ni(II), Zn(II), Mg(II), Be(II), Fe(III), and Al(III), on salicylate fluorescence intensity over the pH range 2 to 7. The cations were chosen in order to study ion size, ion charge, and the difference between transition metals and non-transition metals. Only Cu(II), Be(II), Fe(III), and Al(III) caused any change in the fluorescence, either with regard to intensity or range of emission spectrum. Solutions containing Fe(III) changed on standing. The presence of Cu(II) produced a decrease in fluorescence intensity of salicylate solutions, the decrease becoming greater as the pH increased. Be(II) caused not only a pronounced increase in fluorescence intensity but also a shift of the emission spectrum. (P.C.H.)

33880 INFRARED SPECTROGRAPHY OF URANIUM AND CALCIUM SILICATES. O. Brieux de Mandirola and E. Silberman. Anales Asoc. Quim. Arg., 49: 293-302 (Dec. 1962).

Spectrographic analysis was made of uranophane, ranquilite, haiweeite, and minerals of Si, Al, Mg, Ca, Co, Sb, Pr, Ti, La, Dy, Mn, Sm, and Lu in the 3 microns wave length range. Spectrum changes of ranquilite and the minerals are noted as a function of temperature from 100–1000°C. (Atomdokumentation, 4: No. 14, Nov. 1962)

33881 METALS AND COMPOUNDS OF RARE EARTHS. Ch. de Rohden. Ann. Mines, 63-76(Feb. 1963). (In French)

A review of the physical, thermal, atomic, and crystal properties and application of rare earth elements is presented. Also alkaline and sulfate separation of oxides from ores, chemical precipitation and crystallization of oxides to obtain metals and electrolysis (800 C) and casting processes to produce mishmetal ingots are summarized. (Rev. Metal Lit., 20: No. 6, June 1963)

33882 CATION ABSORPTION BY BENTONITE IN SOLUTION CONTAINING RADIOACTIVE ISOTOPES. Tsutomu Ojima, Hirokazu Toratani, and Hiroshi Fujimoto. Ann. Rept. Radiation Center Osaka Prefect., 3: 125-7 (1962). (In English)

The absorption capacity of bentonite for radioactive and nonradioactive cations was determined. It is reported that the cation absorption ratio of bentonite determined by a chemical method is lower than that obtained by a radioactive counting method. The cations used were Ca, Ca^{45}, Rb, and Rb^{86}. (P.C.H.)

33883 THE SPECTRA OF THE DOUBLY AND TRIPLY IONIZED RARE EARTHS. G. H. Dieke and H. M. Crosswhite (Johns Hopkins Univ., Baltimore). Appl. Opt., 2: 675-86(July 1963).

The present status of the knowledge of the structure of the spectra of the doubly and triply ionized spectra of the rare earths is derived partly from experimental data of the emission spectra of the free ions which provide the energy level scheme in great detail but are difficult and laborious to analyze. For the lower levels knowledge of the structure comes from the crystal absorption and fluorescence spectra. In all cases approximate theoretical calculations of the energies are essential. (auth)

33884 WAVELENGTH MEASUREMENTS WITH A CONCAVE GRATING SPECTROGRAPH. Frank S. Tomkins and Mark Fred (Argonne National Lab., Ill.). Appl. Opt., 2: 715-25(July 1963).

Certain disadvantages and limitations in conventional methods of measuring wavelengths from grating spectrograms are discussed, and some alternative procedures described. It is shown that by fitting thorium standards to the dispersion of the Argonne 9.15-m spectrograph, using a polynomial least-squares program with a digital computer, wavelengths accurate to 1 in 10^6 can be obtained at a rate of 1000 per day. (auth)

33885 SPECTROPHOTOMETRIC STUDIES OF THE COMPLEXES OF PHENYLAZOCHROMOTROPIC ACID

FORMED WITH THORIUM. Haruo Miyata (Okayama Univ., Japan). Bull. Chem. Soc. Japan, 36: 382-5(Apr. 1963). (In English)

The dissociation constant of phenylazochromotropic acid, pK_a, was estimated spectrophotometrically to be 9.3$_9$ (25°C, μ = 0.1). The reagent reacts with Th in the molar ratio 1 : 1, displacing one H atom, and the approximate value of the apparent stability constant of the complex, log K', was estimated to be 3.4 ~ 4.9 in the 2 ~ 3.5 pH range. (auth)

33886 SPECTROPHOTOMETRIC STUDIES OF THE COMPLEXES OF o-SULFOBENZENEAZOCHROMOTROPIC ACID FORMED WITH THORIUM. Haruo Miyata (Okayama Univ., Japan). Bull. Chem. Soc. Japan, 36: 386-9(Apr. 1963). (In English)

o-Sulfobenzeneazochromotropic acid was prepared in the form of reddish brown needles of the monosodium salt, and the value of the first dissociation constant, pK_{a1}, was estimated spectrophotometrically to be 9.7$_6$ (25°C, μ = 0.1). The reagent reacts with Th in the molar ratio 1 : 1, displacing one H atom, and the approximate value of the apparent stability constant of the complex, log K', was estimated to be 3.2 ~ 4.2 at pH values from 2.5 to 3.5 while the concentration of Th was about $(4 \sim 8) \times 10^{-5}$. (auth)

33887 THE DENSITY AND SURFACE TENSION OF MOLTEN BORON. F. N. Tavadze, I. A. Bairamashvili, D. V. Khantadze, and G. V. Tsagareishvili (Inst. of Metallurgy, Academy of Sciences, Georgian SSR). Dokl. Akad. Nauk SSSR, 150: 544-6(May 21, 1963). (In Russian)

A 0.3 to 1.0 g sample of boron (99.8% purity) was fused in a vacuum of 5×10^{-5} mm Hg std by heating in a focused electron beam. The density of the fused boron was determined from the weight of the fused boron drop after the experiment divided by the volume of the drop calculated from a photograph of the drop. The density of the fused boron was found to be 2.08 ± 0.03 g/cm^3 at a temperature 50°C above the melting point of the boron. The surface tension of boron from photographs of the recumbent drops determined by means of tables, was found to be 1080 dynes/cm. The surface tension was also found by the hanging drop method (1070 dynes/cm), and also from the weight of the separated drop (1030 dynes/cm) on boron rods with diameters of 4, 6, and 9 mm. The surface tension did not vary with the diameter of the boron rod. The average surface tension of molten boron was taken to be 1060 ± 50 dynes/cm. (TTT)

33888 THE LOW-TEMPERATURE HEXAGONAL MODIFICATION OF $NaYF_4$ HAVING THE STRUCTURE OF GAGARINITE. B. P. Sobolev, D. A. Mineev, and V. P. Pashutin (Inst. of Mineralogy, Geochemistry, and Rare Element Crystal Chemistry, Academy of Sciences, USSR). Dokl. Akad, Nauk SSSR, 150: 791-4(June 1, 1963). (In Russian)

The compound $NaYF_4$ was prepared by two methods: the recrystallization of a melt having the stoichiometric composition of $NaYF_4$ under hydrothermal conditions at a temperature below the $\alpha \rightarrow \beta$-transition, and the synthesis of $NaYF_4$ under hydrothermal conditions from sodium fluoride and yttrium oxide with a mol ratio of Na : Y = 1 : 1. The results of chemical analyses showed that the compound has the composition $NaYF_4$. The x-ray data showed that the compounds obtained by both methods are identical, and have a structure which differs from the high-temperature modification α-$NaYF_4$ having a fluorite structure. The x-ray data for the β-$NaYF_4$ form showed that β-$NaYF_4$ is similar to the recently discovered mineral gagarinite which has the formula Na(Y,Ca)F$_6$. The lattice parameters of the hexagonal elementary cell of β-$NaYF_4$ are c_0 = 3.53 and a_0 = 5.96 a_0 which compare with lattice parameters of c_0 = 3.53 and a_0 = 5.99 Å in the natural mineral gagarinite. The formula of β-$NaYF_4$ should be written as $Na(Y_{1.5}Na_{0.5})F_6$, since the x-ray data showed that there are 1.5 formula units in each elementary cell. The hexagonal modification is transformed to the cubic form at 670°C. The reverse $\alpha \rightarrow \beta$-transition is very slow. (TTT)

33889 THE HAFNATES OF LANTHANUM AND NEODYMIUM. L. N. Komissarova, Vikt. I. Spitsyn, and Kên-shih Wang (Moscow State Univ.). Dokl. Akad. Nauk SSSR, 150: 816-9(June 1, 1963). (In Russian)

A mixture of HfO_2 (99.24% HfO_2 and 0.65% ZrO_2 impurity) and La_2O_3 (99.99% pure) or Nd_2O_3 (>99.5% pure) were calcined for 8 to 20 hours at 1300°. A mixture of the hydroxides was also precipitated with ammonia, and calcined for 8 hours at 900°C and 20 minutes at 1300°C. The calcined samples were reduced to a particle size of <100μ for the thermogravimetric and x-ray analyses. On calcining at 900° and 1300°, the roentgenograms showed that a new phase with the crystal structure of pyrochlore was formed. No lines due to HfO_2 and La_2O_3 were detected. The coprecipitated hydroxides formed the new phase at a lower temperature during the dehydration process. The mixture of dry powders reacted only after prolonged calcination at 1300°C or higher. The $La_2Hf_2O_7$ compound had a lattice parameter of 10.749 ± 0.001 Å, a density of 7.96 g/cm^3, and a melting point of 2300 ± 30°C. The corresponding values for the $Nd_2Hf_2O_7$ compound were 10.627 ± 0.001 kX, 8.36 g/cm^3, and 2400 ± 30°C. Roentgenograms taken before and after fusion showed that these compounds have high thermal stability. The specific electrical resistance ρ of $La_2Hf_2O_7$ decreased from 8.58×10^{10} ohm-cm at 400°C to 1.57×10^7 ohm-cm at 800°C. A plot of lg ρ versus $10^3/T$ gave a straight line. $La_2Hf_2O_7$ did not react readily with CCl_4 at 600–800°C, or with concentrated acid or alkali solutions. (TTT)

33890 THE PERMEABILITY OF CATION MEMBRANES WITH RESPECT TO LIGHT AND HEAVY WATER. V. P. Meleshko and O. N. Myagkoi (Voronezh State Univ., USSR). Dokl. Akad. Nauk SSSR, 150: 842-4(June 1, 1963). (In Russian)

A sulfonated polystyrene cation membrane was mounted and clamped between two evacuated chambers. Pure H_2O, 25% D_2O, 50% D_2O, 75% D_2O, and 100% D_2O was introduced into evacuated chamber 1, and the time that it took to attain a pressure in chamber 2 equal to about 92% of the pressure in chamber 1 was determined manometrically. The time in reciprocal minutes was taken as a measure of the permeability of the membrane. It was found that the permeability of the membrane decreased with increasing D_2O content, and increased with increasing temperature. The premeability of the membrane in the lithium form was greater than the premeability of the membrane in the barium form. The relative swelling of the membrane could be correlated with its permeability. (TTT)

33891 A MASS SPECTROMETRIC METHOD FOR THE DETERMINATION OF THE PARTIAL VAPOR PRESSURE AND THE RELATIVE IONIZATION CROSS SECTIONS OF MOLECULES FROM THE TOTAL EVAPORATION ISOTHERMS. L. N. Sidorov and P. A. Akishin (Moscow State Univ.). Dokl. Akad. Nauk SSSR, 151: 136-9(July 1, 1963). (In Russian)

The mass spectrometric method is currently used for the determination of the molecular composition of vapors of both single compounds and 2-component systems. Overlapping of the mass spectra of the molecules contained in

the vapor makes it difficult to determine quantitatively the partial pressures, if no data are available on the relative ionization cross sections of the nonvolatile compounds. A correlation was derived for the total evaporation isotherm of 2-component systems so that the dependence of the partial pressure on the composition of the condensate and the ionization cross sections of the molecules present in the vapor phase could be calculated. This supplements the method of using azeotropic mixtures with a known vapor-phase composition for the determination of the relative ionization cross section (A. W. Searcy et al. J. Chem. Phys. 32: 957(160) No. 3). The method was applied for the study of the $NaF-ZrF_4$ system. The entalpies of dissociation of the $NaZrF_5$ and Na_2F_2 were found to be, by chemical reaction isobars, 62.2 ± 4.6 and 54.9 ± 2.2 kcal/mol, respectively. (TTT)

33892 THE DETERMINATION OF THE ACENAPHTHENEQUINONE SPACE GROUP. Jelica Misovic and S. Ramasechan (Indian Inst. of Science, Bangalore). Glasnik Hem. Drustva, Beograd, 27: 4, 177-8(1962).

The space group of acenaphthenequinone crystals was determined by means of x-ray tests. The symmetry displayed by the rotation and Weissenberg pictures of the zero, first, and second layers showed unequivocally that the crystal belongs to the space group $P\ 2_12_12_1$. (OTS)

33893 CHELATE FORMATION BETWEEN THORIUM ION AND SODIUM ALIZARIN 3-SULPHONATE. PART II. ABSORPTIOMETRIC AND ELECTRICAL CONDUCTANCE STUDIES ON THE COMPOSITION AND STABILITY OF CHELATE. Suresh C. Srivastava and Arun K. Dey (Univ. of Allahabad, India). Indian J. Chem., 1: 242-4(June 1963).

Thorium(IV) and Na alizarin 3-sulfonate combine in the ratio of 1:2 to give a pink-colored chelate exhibiting maximum absorbance at 520 mμ. The chelate is stable between pH 2.85 and 8.00. The value of log K (stability constant) was found to be 8.2 ± 0.2 and that of the free energy change of formation to be −11.4 ± 0.3 kcal at pH 4.5, temperature 30°C, and ionic strength 0.1M. (auth)

33894 SOME PREDICTED CHEMISTRY OF GROUP VIII ELEMENTS; THE AEROGENS. Richard M. Noyes (Univ. of Oregon, Eugene). J. Am. Chem. Soc., 85: 2202-4(Aug. 5, 1963).

The generic term aerogen is proposed for the elements of group VIII of the periodic table. The much greater ease with which the heavier aerogens form polyfluorides than polychlorides is more easily explained by the 3-center–4-electron description than by hybridization with d-orbitals. A search for the hypothetical hydrides PH_5 and ClH_3 might provide evidence bearing on which bonding description of the aerogen polyhalides is more satisfactory. Aerogen oxides could be prepared by photolysis with ozone in condensed media. The aerogens may also react with ^1D sulfur atoms and form gaseous complexes with the polyatomic Lewis acids BF_3 and SO_3. The diatomic radical species NeF should be present in equilibrium concentration of the order of a per cent in gas mixtures at a few atmospheres. With the possible exception of HeH, other diatomic radical species should be formed less easily. The aerogens might accept protons from strong gaseous Brönsted acids and form crystalline solids. Necessary proton affinity data are not available, but it seems doubtful that such solids will form with the hydrogen halides. They may form with stronger gaseous proton acids. (auth)

33895 MÖSSBAUER RESONANCE EFFECTS IN IRON^6 ORGANOMETALLIC COMPLEXES. R. L. Collins and R. Pettit (Univ. of Texas, Austin). J. Am. Chem. Soc., 85: 2332-3(Aug. 5, 1963).

The Fe^{57} Mössbauer resonance absorption results of a series of diene–$Fe(CO)_3$ complexes and dienyl–$Fe(CO)_3$ complex cations are reported. In common with most other Fe compounds, the Mössbauer spectra of these materials consist of two absorption lines of equal intensity. The diene–$Fe(CO)_3$ complexes show strong quadrupole splitting and possess a chemical shift within the fairly narrow region $\delta = 0.2 \pm 0.025$ mm/sec. The dienyl–$Fe(CO)_3$ cationic complexes clearly form a separate group based upon their chemical shift, though they display roughly the same range of quadrupole splitting as seen in the diene–$Fe(CO)_3$ complexes. (P.C.H.)

33896 PROPERTIES AND INFRARED SPECTRA OF ETHYLENEDIAMINETETRAACETIC ACID COMPLEXES. V. BONDING AND STRUCTURE OF SEVERAL METAL CHELATES IN SOLUTION. Donald T. Sawyer and James E. Tackett (Univ. of California, Riverside). J. Am. Chem. Soc., 85: 2390-4(Aug. 20, 1963).

The ethylenediaminetetraacetic acid complexes of the alkaline earth ions, Co(II), Ni(II), Cu(II), Zn(II), Cd(II), Mn(II), Pb(II), Bi(III), Ce(III), Al(III), Fe(III), Cr(III), Th(IV), and V(IV) in aqueous solution were studied by infrared spectroscopy using deuterium oxide as the solvent. The effect of solution acidity upon the spectra was determined and from this stability constants were estimated for several of the chelate systems. The shift in peak position and area for the carboxylate–carboxylic acid absorption band was used to propose structures for the complexes in solution. The data indicate that there is some tendency for metal–nitrogen coordination in the alkaline earth–EDTA chelates, but that such bonding is present to a much greater extent with the complexes of the divalent transition metal ions. The structures proposed for the Fe(III), Al(III), and Cr(III) complexes are more complex and involve hydroxide groups as well as the EDTA ligand. (auth)

33897 ELECTRON-DENSITY DISTRIBUTIONS IN HYDRIDE MOLECULES. THE AMMONIA MOLECULE. R. F. W. Bader and G. A. Jones (Univ. of Ottawa). J. Chem. Phys., 38: 2791-2802(June 15, 1963).

The electron-density distribution was determined for the ammonia molecule in its equilibrium configuration by requiring the distribution to exert forces on the nuclei equal and opposite to the nuclear forces of repulsion. The density distribution so obtained was compared with those determined by SCF calculations. All of the density functions were tested by comparing the calculated and observed values for the following molecular properties: the forces on the nuclei; the dipole moment; the electric-field gradient at the nitrogen nucleus; the diamagnetic susceptibility; and the diamagnetic contribution to the nuclear shielding constant. (auth)

33898 BONDING WAVEFUNCTIONS IN THE XENON FLUORIDES. Richard Bersohn (Columbia Univ., New York). J. Chem. Phys., 38: 2913-14(June 15, 1963).

A quadrupole coupling criterion is proposed to evaluate the bonding in the xenon fluorides. Localized valence bonds will give a much higher quadrupole coupling constant for Xe^{131} than the delocalized linear combinations of p functions used in the polyhalides. (auth)

33899 ZERO-FIELD ELECTRON MAGNETIC RESONANCE IN SOME INORGANIC AND ORGANIC RADICALS. Terry Cole, Toshimoto Kushida, and Hanan C. Heller (Ford Motor Co., Dearborn, Mich.). J. Chem. Phys., 38: 2915-24(June 15, 1963).

Zero-field electron magnetic resonance (EMR) spectra were observed for several dilute paramagnetic systems. Among these are peroxylamine disulfonate ions in aqueous

solutions, Cr^{3+} in single crystals of MgO, free radicals in x-irradiated powders of malonic acid, potassium hydrogen malonate, dipotassium malonate, succinic acid, and glutaconic acid. Zero-field spectra were observed by means of a marginal oscillator-detector. The zero-field splittings in the systems studied were due exclusively to the hyperfine couplings between electronic and nuclear spins. Results obtained were in good agreement with high-field EMR measurements on the systems. In several cases the hyperfine couplings were obtained with greater precision than at high field. In addition, the radical $^-OOC-CH-COO^-$ was identified, for the first time, in irradiated dipotassium malonate by means of its zero-field spectrum. No zero-field lines could be detected in electron-irradiated polyethylene. Advantages and disadvantages of the zero-field technique are discussed. (auth)

33900 MICROWAVE SPECTRUM, STRUCTURE, AND QUADRUPOLE COUPLING CONSTANT TENSOR OF ETHYL BROMIDE. Cyprian Flanagan and Louis Pierce (Univ. of Notre Dame, Ind.). J. Chem. Phys., 38: 2963-9(June 15, 1963).

The microwave spectra of 10 isotopic species of ethyl bromide were measured and assigned. The spectra reported lie in the region of 18 to 31 kMc. The complete structure was determined by the substitution method, giving the following bond parameters: CC = 1.518 Å, CBr = 1.950 Å, CCBr = 111°2', CH (methylene) = 1.087 Å, HCH (methylene) = 109°54', CCH (methylene) = 112°15', HCBr = 105°25', CH (methyl) = 1.093 Å, and HCH (methyl) = 108°52'. The principal quadrupole coupling parameters were determined to be $\chi_{zz} = 541$ Mc; $\chi_{xx} = -267$ Mc, and $\chi_{yy} = -274$ Mc for $C_2H_5{}^{79}Br$ and $\chi_{zz} = 450$ Mc, $\chi_{xx} = -220$ Mc, and $\chi_{yy} = -230$ Mc for $C_2H_5{}^{81}Br$. Through the analysis of second-order effects of quadrupole coupling on hyperfine structure, it was determined that, within experimental error, the CBr internuclear line and the z principle quadrupole axis coincide, indicating that the CBr bond is not bent. The barrier to internal rotation, recalculated using Lide's splitting measurements, and the above structure is 3684 cal/mole. (auth)

33901 MASS-SPECTROMETER INVESTIGATION OF ELECTRON-IMPACT PROCESSES AT PRESSURES TO 1 MM Hg. R. K. Curran (Westinghouse Research Labs., Pittsburgh). J. Chem. Phys., 38: 2974-8(June 15, 1963).

A mass spectrometer for the study of secondary reactions involving ions, excited species, and molecules is described. The instrument was checked with the Hornbeck–Molnar process for He_2^+ formation in He, O_3^+ and O_4^+ formation in O_2 and N_3^+ and N_4^+ formation in N_2. Source pressures to about 1 mm Hg are used. The electron beam is controlled by the retarding potential-difference technique for reducing the effective width in energy of the electron distribution. (auth)

33902 HIGH-RESOLUTION F^{19} AND Xe^{129} MAGNETIC DOUBLE RESONANCE SPECTRUM OF $XeOF_4$. Thomas H. Brown, E. B. Whipple, and Peter H. Verdier (Union Carbide Research Inst., Tarrytown, N. Y.). J. Chem. Phys., 38: 3029-30(June 15, 1963).

A method is described for obtaining high resolution F^{19} and Xe^{129} magnetic double resonance spectrum of $XeOF_4$. The F^{19} spectrum was observed with a standard high-resolution spectrometer operating at fixed frequencies of 56.442 and 15.000 Mc. Double resonance experiments were carried out by observing the fluorine resonances at 56.442 Mc while injecting a variable tickling frequency in the vicinity of 16.7 Mc across the transmitter coil of the spectrometer probe. The tickling field was obtained initially from a modified radiotransmitter driven at 8.35 Mc either by a signal generator or by a variable-frequency r-f unit. (P.C.H.)

33903 FLUORESCENCE OF EUROPIUM THENOYLTRIFLUOROACETONATE. I. EVALUATION OF LASER THRESHOLD PARAMETERS. H. Winston, O. J. Marsh, C. K. Suzuki, and C. L. Telk (Quantum Tech. Labs., Inc., Santa Ana, Calif.). J. Chem. Phys., 39: 267-71(July 15, 1963).

A crystalline form of europium thenoyltrifluoroacetonate (EuTTA) with an mp of 164–166°C was prepared. Measurements of absorption and emission spectra, fluorescence lifetime, and relative quantum yield were made on solutions of EuTTA in acetone, toluene, and ethanol. From these measurements the required laser threshold concentration of excited EuTTA molecules in acetone at room temperature for a laser cavity with an optical loss of 1%/cm calculated to be 2.3×10^{17} cm^{-3}. (auth)

33904 FLUORESCENCE OF EUROPIUM THENOYLTRIFLUOROACETONATE. II. DETERMINATION OF ABSOLUTE QUANTUM EFFICIENCY. R. A. Gudmundsen, O. J. Marsh, and E. Matovich (Quantum Tech. Labs., Inc., Santa Ana, Calif.). J. Chem. Phys., 39: 272-4(July 15, 1963).

The absolute quantum efficiency of the fluorescence of europium thenoyltrifluoroacetonate in acetone was measured by a calorimetric method, and substantiated by comparing the output against that from acridone. The quantum efficiency of the fluorescence, which peaks at 6122 Å, from acetone solutions at 25°C is 0.56 ± 0.08. (auth)

33905 EQUILIBRIUM COMPOSITION OF SULFUR VAPOR. J. Berkowitz (Argonne National Lab., Ill.) and J. R. Marquart. J. Chem. Phys., 39: 275-83(July 15, 1963). (TID-18365; UAC-7235)

Sulfur vapor, as well as the vapors in equilibrium with solid HgS, CdS, ZnS, FeS, SrS, and CaS were studied mass-spectrometrically. The results indicate the presence of all possible S_n molecules between S_2 and S_8 in measurable concentration between room temperature and the boiling point of sulfur. Negligible concentrations of S_9 and S_{10} were also observed. The high-temperature experiments were most concordant with the high value of $D_0(S_2)$, about 4.4 ev. For the reactions $(n/8)S_8 \rightarrow S_n (n = 2, 3, 4, 5, 6, 7)$, the enthalpy changes at ~400°K are $\Delta H_2 = 23.5$ kcal/mole, $\Delta H_3 = 22.5$ kcal/mole, $\Delta H_4 = 20.5$ kcal/mole, $\Delta H_5 = 14.3$ kcal/mole, $\Delta H_6 = 6.2$ kcal/mole, and $\Delta H_7 = 5.7$ kcal/mole. (auth)

33906 DISSOCIATION ENERGIES OF SOME METAL SULFIDES. J. R. Marquart (Argonne National Lab., Ill. and Univ. of Illinois, Urbana) and J. Berkowitz. J. Chem. Phys., 39: 283-5(July 15, 1963). (TID-18351; UAC-7234)

The dissociation energies (or upper limits to D_0) of the following molecules were deduced from a mass-spectrometric study: $D_0(CaS) = 79.5$ kcal/mole, $D_0(SrS) = 80$ kcal/mole, $D_0(FeS) \leq 77$ kcal/mole, $D_0(ZnS) \leq 50$ kcal/mole, $D_0(CdS) \leq 47$ kcal/mole, and $D_0(HgS) \leq 50$ kcal/mole. (auth)

33907 FLUORESCENCE LIFETIME OF THE EUROPIUM DIBENZOLYMETHIDES. Max Metlay (General Electric Co., Schenectady, N. Y.). J. Chem. Phys., 39: 491-2 (July 15, 1963).

The fluorescence lifetimes of dibenzoylmethane containing four molecules per atom of europium (EuD_4) and a chelate containing three molecules (EuD_3) are reported. The lifetimes were found to be 80 ± 3 and 369 ± 15 for EuD_3 and 533 ± 10 and 533 ± 20 for EuD_4 at 300 and 77°K, respectively. The infrared spectrum of EuD_4 shows a strong absorption at 1415 cm^{-1}, absent in EuD_3, which can be at-

tributed to a hydrogen bending vibration of a methylene group adjacent to a carbonyl. Reasons for the difference between the lifetimes of EuD_3 and EuD_4 are discussed. (P.C.H.)

33908 RARE-EARTH TUNGSTATES AND 1 : 1 OXYTUNGSTATES. Hans J. Borchardt (E. I. du Pont de Nemours and Co., Wilmington, Del.). J. Chem. Phys., 39: 504-11(Aug. 1, 1963).

The normal tungstates ($R_2O_3 \cdot 3WO_3$) of all rare-earth elements were prepared as well as the 1 : 1 oxytungstates ($R_2O_3 \cdot WO_3$) of all except Sc and Ce. Physical properties were studied with particular emphasis on luminescence. (auth)

33909 ELECTRONIC STRUCTURE OF LiH AND QUADRUPOLE MOMENT OF Li^7. S. L. Kahalas and R. K. Nesbet (Boston Univ.). J. Chem. Phys., 39: 529-44(Aug. 1, 1963).

Hartree-Fock self-consistent field calculations of the Roothaan (LCAO–MO) type were carried out on an electronic computer for LiH using an extended set of basis functions. Configuration interaction calculations resulted in a total molecular energy of 99.3% and a dissociation energy of 89.3% of the experimental values. It was found that large contributions occur from $p\pi$ orbitals in configuration interaction. Using a general method developed, the electric-field gradient was calculated in LiH. With Klemperer, Gold, and Wharton's measurement of the LiH quadrupole coupling constant, the quadrupole moment of the Li^7 nucleus was found to be -4.4×10^{-26} cm^2. This sign was unambiguously determined to be negative, in agreement with theoretical predictions from nuclear models. The dipole moment of LiH was calculated to be -5.89 D, and the quadrupole coupling constant of deuterium in LiD was calculated to be 35.3 kc/sec. (auth)

33910 THERMODYNAMIC PROPERTIES OF CH_4 AND CD_4. INTERPRETATION OF THE PROPERTIES OF THE SOLIDS. J. H. Colwell, E. K. Gill, and J. A. Morrison (National Research Council, Ottawa). J. Chem. Phys., 39: 635-53(Aug. 1, 1963).

The results of calorimetric measurements of the heat capacities of solid and liquid CH_4 and CD_4, the heats of fusion of both substances and the heat of vaporization of CD_4 are given. The results for the solids, which extend from 2.3°K to the triple points, were analyzed in some detail. In order to account for the apparent zero-point entropies of both CH_4 and CD_4 quantitatively, it was necessary to recognize the existence of different nuclear spin species (as with ortho and para hydrogen) and to say that, as T approaches 0°K, each species tends to occupy its lowest available molecular energy level. No conversion between the different species was observed. The relevance of these findings to the usual applications of the third law of thermodynamics is discussed. The thermal transitions which occur in solid CH_4 and CD_4 (as well as in the partially deuterated methanes) were also examined and an attempt was made to correlate the thermodynamic results with information derived from other experiments (e.g., spectroscopic, neutron scattering) and from theory. While correlations are possible, the fundamental causes of the transitions can still not be established. (auth)

33911 VARIATIONAL CALCULATIONS OF SOME S STATES IN TWO-ELECTRON ATOMS. J. F. Perkins (U. S. Army Missile Command, Redstone Arsenal, Ala.). J. Chem. Phys., 39: 687-93(Aug. 1, 1963).

Nonrelativistic energies of the 2^1S and 2^3S states of He, Li^+, and Be^{2+}, and the 3^1S and 3^3S states of He and Li^+ were calculated by the Rayleigh-Ritz variational method, using expansions in r_1, r_2, and r_{12} as originally employed by Coolidge and James. Mass polarization corrections and $\langle\delta(r_2)\rangle$ were also evaluated. For states for which values of relativistic and electromagnetic shifts are available, the energies calculated with 31-term expansions, after correction for these shifts and for nuclear motion, differed from experimental values by about 2 or 3 cm^{-1} for singlet and about 0.4 cm^{-1} for triplet states. The relative effectiveness of expansions involving one, two, or three exponential parameters is discussed. A search was made for a bound 2^3S state of H^- but no indication of the existence of such a state was found. (auth)

33912 ENERGY DEPENDENCE OF CROSS SECTIONS FOR ION MOLECULE REACTIONS. TRANSFER OF HYDROGEN ATOMS AND HYDROGEN IONS. Clayton F. Giese and William B. Maier, II (Univ. of Chicago). J. Chem. Phys., 39: 739-48(Aug. 1, 1963).

Measurements of cross sections for ion–molecule reactions by use of a technique which involves preselection of the primary ion in terms of both mass and kinetic energy are described. Cross sections as functions of ion kinetic energy are given for the reactions $Ar^+ + D_2 \rightarrow ArD^+ + D$, $N_2^+ + D_2 \rightarrow N_2D^+ + D$, $H_2^+ + H_2 \rightarrow H_3^+ + H$, $D_2^+ + N_2 \rightarrow N_2D^+ + D$, $H_2^+ + He \rightarrow HeH^+ + H$, and $D_2^+ + Ar \rightarrow ArD^+ + D$. The behavior of the cross sections for the first two of these reactions, which can be considered to involve hydrogen atom transfer, is strikingly different from that of the remaining four, which can be taken as cases of hydrogen ion transfer. The comparison with previous measurements shows fair agreement; however, agreement with existing theories is rather poor. (auth)

33913 VAPOR-LIQUID EQUILIBRIA OF DILUTE SOLUTIONS OF HT IN e-H_2 AND DT IN e-D_2 FROM THE TRIPLE POINTS TO THE CRITICAL TEMPERATURES OF THE SOLUTIONS. Jacob Bigeleisen (Brookhaven National Lab., Upton, N. Y.) and Eugene C. Kerr. J. Chem. Phys., 39: 763-8(Aug. 1, 1963). (BNL-6786)

The liquid-vapor fractionation factors for dilute solutions of HT in e-H_2 and DT in e-D_2 were measured over the temperature ranges 13.95 to 30.26 and 18.67 to 32.48°K, respectively. At these temperatures the respective fractionation factors are 3.66, 1.24, 1.36, and 1.07. In all cases the heavy isotope concentrates in the liquid phase. The solutions obey Henry's law in the concentration range studied (1 to 2×10^{-3} M). The fractionation factors vanish at the critical temperatures of the respective solvents. The differences in the partial molal heats of vaporization of the isotopes are functions of the temperature. It is shown conclusively that the fractionation factors for the HT–H_2 mixtures are appreciably smaller (~24%) than those to be expected for dilute mixtures of D_2 in H_2. The difference in behavior of HT from D_2 is a manifestation of the effect of the molecular structure on the phase equilibrium properties of the liquid. The principal structural effect is shown, by comparison of the experimental data with theoretical calculations, to be a coupling of the molecular rotation with the hindered translation of the molecule in the liquid. (auth)

33914 QUANTUM EFFECTS IN LIQUID HYDROGEN. Jacob Bigeleisen (ETH, Zurich and Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys., 39: 769-77(Aug. 1, 1963). (BNL-6787)

The thermodynamic description of a nonideal two-component solution was developed for the case where the excess free energy of mixing in the liquid has its origin in the volume change on mixing. The equilibrium con-

dition was calculated for the real gas. The equilibrium vapor–liquid distribution was related to the partition functions of the components in the liquid phase and the ideal gas. This relationship afforded a basis for the calculation of the partition function ratios HT/H_2 and DT/D_2 in the liquid phase from experimental data. Partition function ratios of HD/H_2, D_2/H_2, and T_2/H_2 in the liquid state were derived from vapor-pressure data. It is shown that the method of ordered quantum corrections is an inconvenient one for the description of the quantum effects in liquid hydrogen in its various isotopic forms. "Lattice" zero-point energy differences for the isotopic liquid hydrogens were derived from the partition functions under the assumption of free rotation in the liquid. A large asymmetry effect was found for the heteronuclear species HD, HT, and DT. The "lattice" zero-point energy of HT was 5.54°K greater than that of D_2, which has the same molecular weight. The structural effect of the molecule is shown to be a consequence of quantum mechanical coupling of rotation with the libration of the molecule in the condensed phase. Comparisons were made with two simple models of the coupling, both of which give qualitative agreement with experiment but overemphasize the coupling. A coupling parameter was derived from the experimental data to describe the translation–rotation interaction in an anharmonic potential field. It is shown that the anharmonic correction to the thermodynamic properties of condensed hydrogen is large. (auth)

33915 ABSORPTION AND FLUORESCENCE SPECTRA OF SEVERAL PRASEODYMIUM-DOPED CRYSTALS AND THE CHANGE OF COVALENCE IN THE CHEMICAL BONDS OF THE PRASEODYMIUM ION. Eugene Y. Wong, Oscar M. Stafsudd, and David R. Johnston (Univ. of California, Los Angeles). J. Chem. Phys., 39: 786-93(Aug. 1, 1963).

The absorption and fluorescence spectra of praseodymium-doped lanthanum trifluoride, lanthanum ethyl sulfate, and yttrium aluminum garnet single crystals are reported. The center of gravity of each J level was shifted to the red when the nearest neighbors of the praseodymium ion changed in the order of fluorine, water, chlorine, bromine, and oxygen. This corresponded to an increase of covalent character by 0.7, 0.9, 1.1, and 2.0% for Pr–H_2O, Pr–Cl, Pr–Br, and Pr–O bonds when compared with Pr–F. (auth)

33916 DISSOCIATION CONSTANTS OF SOME BARIUM, EUROPIUM, AND HEXAAMMINECOBALT ION-PAIRS BY USE OF SPARINGLY SOLUBLE IODATES CONTAINING RADIOTRACERS. S. H. Laurie and C. B. Monk (University College of Wales, Aberystwyth, Eng.). J. Chem. Soc., 3343-7(June 1963).

The solubilities of barium iodate containing I^{131}, europium iodate containing $Eu^{(152+154)}$, and hexamminecobalt iodate containing Co^{60} in salt solutions of ion-pairing ligands were measured by relating the count rates to the solubilities in H_2O at 25°C as found by volumetric estimation of the iodate concentrations. The results, combined with Davies's general activity coefficient expression, were used to calculate the corresponding dissociation constants. It was also demonstrated that such calculations may be made with only rough estimates of the solubilities in H_2O combined with the relative count rates of the aqueous salt solutions. (auth)

33917 ALUMINIUM HYDRIDE ADDUCTS OF TRIMETHYLAMINE: VIBRATIONAL SPECTRA AND STRUCTURE. G. W. Fraser, N. N. Greenwood, and B. P. Straughan (King's Coll., Newcastle-upon-Tyne, Eng.). J. Chem. Soc., 3742-9(July 1963).

The compounds Me_3N,AlH_3, Me_3N,AlD_3, $(Me_3N)_2,AlH_3$, and $(Me_3N)_2,AlD_3$ were synthesized and their gas-phase infrared spectra recorded in the range 400 – 4000 cm^{-1}. The Raman spectrum of bistrimethylamine-alane in an excess of trimethylamine was also studied. The spectra establish that trimethylamine-alane is monomeric (C_{3v} symmetry) and provide cogent evidence for a trigonal-bipyramidal structure (D_{3h}) for the 2:1 adduct in which the two ligands occupy the axial positions. Previous assignments of the Al–H and Al–D stretching and deformation modes were confirmed and the Al–N stretching mode was identified for the first time. It occurs at 533 cm^{-1} in the 1:1 adduct and, as expected, moves to lower wavenumbers when the second ligand molecule is added, the N–Al–N stretching modes occurring at 460 and 461 cm^{-1} in the 2:1 complex. Ambiguities and inconsistencies on the structure of the compounds were resolved on the basis of ready equilibration between the components and the possibility of solvent–solute interaction and dipole–dipole association in solution. (auth)

33918 INFRARED STUDIES OF THE DEUTERIUM ISOTOPE EFFECT IN ACIDS. L. J. Bellamy, A. R. Osborn, and R. J. Pace (Ministry of Aviation, E.R.D.E., Waltham Abbey, Essex, Eng.). J. Chem. Soc., 3749-53(July 1963).

Measurements were made of the OH and OD stretching frequencies of aliphatic carboxylic acids in a number of solvents. These are shown to be related to pK_H and pK_D of the acids, enabling pK_H and pK_D to be predicted for acids of this type from spectroscopic data. The results further provide relative acidity values for [H]- and [D]-acids in non-aqueous solvents. The observed spectroscopic isotope effects are explained in terms of anharmonicity of the particular OH vibration. (auth)

33919 DESORPTION, UNDER NITROGEN OR HYDROGEN, OF HYDROGEN CHEMISORBED ON GRAPHITE. H. Le Bail (Commissariat à l'Energie Atomique, Saclay, France). J. Chim. Phys., 60: 703-5(May 1963). (In French)

The desorption of hydrogen chemisorbed on graphite was studied under nitrogen and hydrogen atmosphere at temperatures from 25 to 900°C. During oxidation under nitrogen at atmospheric temperature, CO essentially was formed and very little CO_2. The release of both gases pass through distinct maxima, with that of CO about 30°C higher than that of CO_2. The presence of some water vapor slightly increases the temperature of the maximum. The desorption under hydrogen releases H_2O, CO_2, and CO. For very pure graphite the point of maximum release for the three gases coincided at 550°C. The desorption of water under hydrogen current is accompanied by a chemisorption of hydrogen that heating under nitrogen at 900°C does not eliminate. The primary phenomena are described. (J.S.R.)

33920 ELECTRONIC STRUCTURE OF URANIUM IN ITS TRI- AND TETRAVALENT COMPOUNDS. B. Jezowska-Trezebiatowska (Univ. of Warsaw). J. Chim. Phys., 60: 843-8(July-Aug. 1963). (In French)

A study is made of the absorption spectra and magnetic susceptibility of U(III) and U(IV) ions in various solvents, and it is concluded that the electronic structure of U(III) is $5f^2d^1$ and that of U(IV) is $5f^2$. (T.F.H.)

33921 ON THE URANATES OF AMMONIUM. II. X-RAY INVESTIGATION OF THE COMPOUNDS IN THE SYSTEM $NH_3–UO_3–H_2O$. P. C. Debets and B. O. Loopstra (Reactor Centrum Nederland, Petten, Netherlands). J. Inorg. Nucl. Chem., 25: 945-53(Aug. 1963).

X-ray powder diagrams of four compounds in the system $NH_3–UO_3–H_2O$ were indexed. The results obtained were: $\beta–UO_3 \cdot 2H_2O$, orthorhombic, a = 13.977 ± 0.004, b = 16.696 ± 0.004, c = 14.672 ± 0.004 Å; $3UO_3 \cdot NH_3 \cdot 5H_2O$, or-

thorhombic, a = 7.220 ± 0.003, b = 12.198 ± 0.003, c = 15.072 ± 0.004 Å; $2UO_3 \cdot NH_3 \cdot 3H_2O$, hexagonal, a = 14.087 ± 0.004 Å, c = 14.494 ± 0.005 Å; and $3UO_3 \cdot 2NH_3 \cdot 4H_2O$, hexagonal, a = 4.031 ± 0.004 Å, and c = 14.58 ± 0.01 Å. The structures consist of hexagonal or pseudohexagonal layers of composition $UO_2(O_2)_{\infty}$, with the additional O and N atoms of water and ammonia between the layers. (auth)

33922 AQUEOUS SYSTEMS AT HIGH TEMPERATURE. X. INVESTIGATIONS ON THE SYSTEMS $UO_3-CuO-SO_3-D_2O$, $UO_3-NiO-SO_3-D_2O$, AND $UO_3-CuO-NiO-SO_3-D_2O$, 260-410°C; LIQUID-LIQUID IMMISCIBILITY AND CRITICAL PHENOMENA. William L. Marshall and Ernest V. Jones (Oak Ridge National Lab., Tenn.). J. Inorg. Nucl. Chem., 25: 1021-31(Aug. 1963).

With the use of the synthetic methods, some phase boundaries of liquid–liquid immiscibility and critical phenomena (where L ≡ V) were determined for the condensed systems $UO_3-CuO-SO_3-D_2O$, $UO_3-NiO-SO_3-D_2O$, and $UO_3-CuO-NiO-SO_3-D_2O$ at temperatures from 280 to 410°C, at SO_3 concentrations varying from 0.02 to 1.0 molal, and at varying molal ratios, UO_3 : CuO : NiO. With some of the results, combined with previous data, three-dimensional models were constructed that specified the saturating phases or critical phenomena, and the variation in phase boundaries as a function of temperature (260 to 430°) and composition (0.02 to 1.0 molal SO_3) for the four-component systems $UO_3-CuO-SO_3-D_2O$ and $UO_3-NiO-SO_3-D_2O$. In the system containing CuO the second liquid phase predominated as a saturating phase at the higher temperatures and extended from the system $UO_3-SO_3-D_2O$ to $CuO-SO_3-D_2O$ whereas, for the system containing NiO the solid, $NiSO_4 \cdot D_2O$, was the predominant saturating phase. In both systems a critical surface was defined over which maximum molal ratios, Σ (metallic oxide) : SO_3, varying from 0.3 to 0.5 were observed. In the two liquid phase regions, as an approximation, CuO, NiO, or both can be stoicheiometrically substituted for UO_3 in small amounts in a particular composition without changing appreciably the temperature of liquid–liquid immiscibility. (auth)

33923 AQUEOUS SYSTEMS AT HIGH TEMPERATURE. XI. EFFECT OF PRESSURE ON LIQUID-LIQUID IMMISCIBILITY IN THE SYSTEM $UO_2SO_4-H_2O$ AND LIQUID-SUPERCRITICAL FLUID EQUILIBRIA IN THE SYSTEM $UO_2SO_4-H_2SO_4-H_2O$; 290-430°C, 75-330 BARS. William L. Marshall and James S. Gill (Oak Ridge National Lab., Tenn.). J. Inorg. Nucl. Chem., 25: 1033-40(Aug. 1963).

By making use of a visual method, the effect of hydrostatic pressures up to 320 bars in raising the temperature, in the vicinity of 300°C at saturation vapor-pressure, of second-liquid phase formation in the system $UO_2SO_4-H_2O$ for solutions varying from 0.14 to 4.5 molal in UO_2SO_4 was found to be +0.082° per bar. One exploratory run each on a solution of UO_2F_2 and H_2O, and of $CuSO_4$, H_2SO_4, and H_2O, both of which show liquid–liquid immiscibility near 320° gave values of $(\partial t/\partial p)$ at constant composition of ~ +0.10 and +0.11, respectively. Since $(\partial t/\partial p)$ at a constant density of 0.712 for liquid H_2O at 300° is +0.093° per bar, the temperature of liquid–liquid immiscibility appears to show a strong dependency on solvent density. The effect of pressures up to 330 bars on the temperature of second-liquid phase formation from the supercritical fluid $UO_3-SO_3-H_2O$ near 400° was found also to correspond approximately to $(\partial t/\partial p)$ at constant density for H_2O at the same initial pressure, the value being in the vicinity of +0.4° per bar. In some additional experiments the vapor-pressures for the deliquescence of solid UO_2SO_4 hydrate were found to vary from 120 bars at 345° to 305 bars at 425°. (auth)

33924 LOW ENERGY LEVELS OF NEUTRAL CERIUM (CeI). William C. Martin (National Bureau of Standards, Washington, D. C.). J. Opt. Soc. Am., 53: 1047-50(Sept. 1963).

The first results of a continuing analysis of the Ce I spectrum show the ground level to be $4f\ 5d\ 6s^2\ {}^1G_4^0$, with $g_J = 0.945$. Of fifteen low odd levels for which the energies and J and g values are given, seven were assigned to $4f\ 5d\ 6s^2$ and five to $4f\ 5d^2\ 6s$. (auth)

33925 A MÖSSBAUER STUDY OF Fe^{57} IN DISTORTING SPINELS. Midori Tanaka (Tokyo Univ.), Tadashi Mizoguchi, and Yoshimichi Aiyama. J. Phys. Soc. Japan, 18: 1089(July 1963).

The effect of cooperative John-Teller distortion on Mössbauer absorption spectra in the paramagnetic state of germanium-substituted copper ferrite was measured. The measurements at 430 and 510°C show almost the same spectra consisting of two absorption lines with isomer shifts of 0.17 and 0.11 mm/sec, and quadrupole splittings of 0.50 and 0.50 mm/sec, respectively. No appreciable change of the quadrupole splitting is present in a cubic phase and in a tetragonal phase. In the ferromagnetic state, directions of spins are uniform in a domain, but those of the electric field gradients at Fe^{57} nuclei on octahedral sites take four equivalent (111) directions in a unit cell, and so the angular part of the quadrupole interaction is not unique. (C.E.S.)

33926 MÖSSBAUER EFFECT IN $Mn_xFe_{3-x}O_4$. Midori Tanaka (Tokyo Univ.), Tadashi Mizoguchi, and Yoshimichi Aiyama. J. Phys. Soc. Japan, 18: 1091(July 1963).

An analysis was made of the Mössbauer effect of Fe^{57} on several specimens of the $Mn_xFe_{3-x}O_4$ system and a $CuFe_2O_4$ sample. In the ferrimagnetic state the absorption spectra was obtained for $MnFe_2O_4$. In the paramagnetic state all specimens show two absorption lines; the splittings being due to the quadrupole interaction. The crystal structure of Mn_2FeO_4 is tetragonal at room temperature and cubic above 450°C. The quadrupole splittings are almost the same in both phases. The temperature dependence of the isomer shift of the specimens in the paramagnetic state is also shown. (C.E.S.)

33927 ENERGETICS OF ION MOLECULE REACTIONS IN ALKANES. Larry Kevan (King's Coll., Newcastle upon Tyne, Eng.). Nature, 199: 562-4(Aug. 10, 1963).

The limiting values were calculated for the heats of reactions in alkanes that are important in radiation chemistry. The values for the parent ions were obtained from the measured ionization potentials, and the other experimental values were determined from the appearance potential of the ion as measured by mass spectrometry. Using the ionization potentials for methane, ethane, and methyl radicals as parameters, the secular equations were solved on an IBM 7090 computer for the normal, iso, secondary, and tertiary radicals having up to 12 carbons. It was found that the radical ionization potentials converged to a constant value for each structural type at the butyl radicals. Thus the values measured for the butyl radicals can be used for the higher alkyl radicals. Data are included on the heats of formation of alkane carbonium ions. (C.H.)

33928 THE SPECTRA OF TRIVALENT CERIUM IONS IN ALKALINE-EARTH FLUORIDE CRYSTALS. A. A. Kaplyanskii, V. N. Medvedev, and P. P. Feofilov. Opt. Spectry. (USSR) (English Transl.), 14: 351-6(May 1963).

The absorption and luminescence spectra of MeF_2-Ce single crystals (Me = Ca, Sr, Ba) were measured at 4.2, 77, and 300°K in the region of the allowed 4f-5d transitions of

the Ce^{3+} ion. These spectra indicated the existence of vibrational sequences of narrow bands and lines; mirror symmetry was observed in the long-wavelength absorption band structure and in two luminescence bands assigned to transitions from the lowest d state to the $^2F_{5/2}$ (ground state) and $^2F_{7/2}$ states. The forbidden transitions between these levels were observed in infrared absorption spectra. (auth)

33929 DOUBLE MAGNETIC RESONANCE. G. E. G. Hardeman (Philips Gloeilampenfabrieken, Eindhoven, Netherlands). Philips Tech. Rev., 24: 206-20(1962-63). (In English)

After recapitulating the theory of paramagnetic resonance (pr) and nuclear magnetic resonance (nr) the effects observed when both forms of resonance are induced simultaneously are discussed. Through the magnetic interaction (coupling) between the electron spins and the nuclear spins, this can cause dynamic nuclear polarization, resulting in amplification of the nr signal. Nuclear polarization can arise through scalar coupling—which occurs when the electron, quantum-mechanically speaking, has a certain probability of being at the same position as the nucleus—and through dipole coupling. The effects differ depending on whether the electrons and nuclei are in relative quiescence or movement. The theory of all these cases is briefly discussed, one or more examples being given, where possible, for each case. The effects described, apart from aiding the analysis of molecular and crystalline structures, can be turned to use in other fields, e.g., for accurately measuring weak magnetic fields and for nuclear physical research on oriented nuclei. Mention is made of the requirements to be met by the experimental equipment, and some existing equipment is briefly discussed. (auth)

33930 SECOND ORDER QUADRUPOLE SHIFTS OF THE Na^{23} MAGNETIC RESONANCE IN ROCHELLE SALT. R. Blinc, M. Mali, and I. Zupančič (Nuclear Institute "Jozef Stefan," Ljubljana, Yugoslavia and Univ. of Ljubljana, Yugoslavia). Phys. Letters, 5: 309-10(Aug. 1, 1963). (In English)

To investigate the changes in the microscopic internal field associated with the ferroelectric transition, the magnetic resonance of Na^{23} in a single crystal of Rochelle salt was studied. Results on the angular dependence of the central component of the Na^{23} line in the high temperature para-electric phase are presented. Only the second order quadrupole shift of the central component with respect to the unperturbed Larmor frequency was measured. Three Na^{23} lines were observed at different orientations at 0°C, demonstrating a rear-arrangement of the surrounding oxygen and hydrogen network in the ferroelectric phase. (C.E.S.)

33931 THERMOLUMINESCENCE IN PLASTICALLY DEFORMED KBr. R. Fieschi, R. Oggioni, and G. Spinolo (Universitá, Milan and Istituto Nazionale di Fisica Nucleare, Milan). Phys. Status Solidi, 3: 1207-13(1963). (In English)

The thermoluminescence of plastically deformed KBr crystals was measured in the temperature range 80 to 350°K for differing amounts of deformation. It was found that the glow peaks characteristic of undeformed crystals are greatly enhanced but that no new glow peaks appear. The effect of annealing at different temperatures, below x-ray excitation showed that the enhanced emission is not due to direct trapping of carriers by dislocations. The study of changes in the absorption spectra indicated that there is no correlation between coloration and enhanced emission of different deformed samples. (auth)

33932 RAMAN SPECTRUM OF LANTHANUM ETHYL SULPHATE NONAHYDRATE. N. Krishnamurthy and R. S. Krishnan (Indian Inst. of Science, Bangalore). Proc. Indian Acad. Sci., Sect., A, 57: 352-60(June 1963). (In English)

The raman spectrum of a single crystal of lanthanum ethyl sulphate was recorded using the λ2537 cm^{-1} radiation. Forty-one lines were identified of which eight belong to the lattice oscillations, seven to the internal vibrations of the water molecule, and the remaining twenty-six to the internal vibrations of the ethyl sulphate group. The Raman spectrum of ethyl sulphate (liquid) was also recorded using the λ4358 cm^{-1} excitation and is compared with the spectrum of lanthanum ethyl sulphate. Thirty Raman lines could be identified in the spectrum of ethyl sulphate, of which fourteen are recorded for the first time. Probable assignments of the observed frequencies are also given. The sulphate group is found to have $O-SO_3$ structure in lanthanum ethyl sulphate, while it has a co-ordination structure in ethyl sulphate. (auth)

33933 THERMOEMISSION PROPERTIES OF LANTHANUM AND CERIUM SULFIDES. V. I. Marchenko, G. V. Samsonov, and V. S. Fomenko. Radiotekhn. i Electron., 8: 1076-81(June 1963). (In Russian)

Thermoemission properties of cerium and lanthanum mono- and sesquisulfides were analyzed. Tabulated data on LaS, La_2S_3, CeS, and Ce_2S_3 emission properties at 1200 to 1700°K showed a low current density (at 1700°K the current density is several ma per cm^2). The thermal yield coefficient for all four sulfides is (1 to 2) × 10^{-3}. (R.V.J.)

33934 VIBRATIONAL SPECTRA OF AQUEOUS OXALATE ION. G. M. Begun and W. H. Fletcher (Oak Ridge National Lab., Tenn.). Spectrochim. Acta, 19: 1343-9 (Aug. 1963). (In English)

New experimental data on the infrared and Raman spectra of aqueous oxalate ion are presented. The data are consistent with a staggered (D_{2d}) configuration for the ion. The fundamental vibrational frequencies (cm^{-1}) assigned on this basis are: A_1—1486, 900, 449; B_2—1579, 524; and E—1310, 761, 301. (auth)

33935 EXPERIMENTAL STUDIES OF HEAVY WATER THERMAL CAPACITY AT HIGH PRESSURES AND TEMPERATURES. S. L. Rivkin and B. N. Egorov (All-Union Heat-Engineering Inst., USSR). Teploenerg., No. 7, 75-6 (July 1963). (In Russian)

Data are given from experimental studies of the thermal capacity of 99.87% liquid heavy water at 100, 150, 200, 225, and 250 kg/cm^2 pressures and of heavy water vapor at 450°C and 150, 175, and 200 kg/cm^2 pressures. The order of error for the liquid is 0.35% and for the vapor, 1 to 2%. (R.V.J.)

33936 A STUDY OF THE TETRABORIDES OF URANIUM AND THORIUM. K. J. Matterson and H. Jones. Trans. Brit. Ceram. Soc., 60: 475-91(July 1961).

The preparation and properties of UB and ThB_4, and to some extent of UB_2 and ThB_6, were studied in view of the possible application of these materials as nuclear fuels. Previous work is briefly reviewed, with particular reference to six reported methods of preparation. The compounds were prepared by reacting the elements in Ar, and fabricated discs and blocks by hot-pressing in graphite dies. UB_2 was found to react with the graphite, forming UB_4, UO_2, and a borocarbide of U. Properties obtained are shown in tables, graphs, and photomicrographs. They include crystallographic structure and lattice parameters, physical properties, oxidation rates, and behavior in gases at temperatures up to 1000°C. All the borides were found

to lose B when heated to elevated temperatures, and may not possess true melting points. UB_4 has higher thermal expansion, microhardness, and modulus of rupture, but lower thermal conductivity and electric resistivity, than ThB_4, and oxidizes almost 10 times more rapidly at 1000°C. (TCO)

33937 HEAT OF DISSOCIATION OF NON-STOICHIOMETRIC CALCIUM URANATE. J. S. Anderson (National Chemical Lab., Teddington, Eng.) and C. G. Barraclough. Trans. Faraday Soc., 59: 1572-9(July 1963).

The equilibrium oxygen pressure above nonstoichiometric $CaUO_X$ ($4 > X > 3.5$) was measured over various ranges of temperature and composition, and thermodynamic quantities for the solid–gas equilibrium were derived. A comparison was made between the experimental results and theoretical calculations for a nonstoichiometric oxide with anion vacancies. (auth)

33938 REPORT ON THE COMPLEX CHEMISTRY OF TECHNETIUM. I. PREPARATION AND PROPERTIES OF CYANOTECHNETATE(IV). K. Schwochau and W. Herr (Universität, Cologne; Max-Planck-Institut für Chemie, Mainz; and Kernforschungsanlage, Julich, Ger.). Z. Anorg. Allgem. Chem., 318: 198-211(Oct. 1963). (In German)

Cyanotechnetate(IV) was prepared by the dissolution of $Tc^{99}O_2$ in a solution of alkaline cyanide. For the isolation and the purification of this complex the Tl(I)-salt was used, which crystallizes in a low symmetric lattice. The elementary analysis leads to the formula $Tl_3[TcO(OH)(CN)_4]$ or $Tl_3[Tc(OH)_3(CN)_4]$, which is in agreement with the molar conductivity and infrared, visible, and ultraviolet spectra. The molar extinction coefficient ϵ_{380nm} was found to be $(4.44 \pm 0.03) \times 10^4$ $mol^{-1} \cdot l \cdot cm^{-1}$. The deviation from Lambert-Beers law yielded the stability constant $K = (1.3 \pm 0.6) \times 10^8$ $mol^{-1} \cdot l$. In the presence of oxidizing agents the complex gets transformed directly to pertechnetat. Under similar conditions of synthesis ruthenium forms the complex ion $[ReO_2(CN)_4]^{3-}$ with a pentavalent central atom. Results proved the difference between technetium and rhenium in the stability of the +5 oxidation state. (auth)

33939 THE PHOSPHATES, ARSENATES, AND VANADATES OF THE RARE EARTHS. H. Schwarz (Technische Hochschule, Karlsruhe, Ger.). Z. Anorg. Allgem. Chem., 323: 44-56(June 1963). (In German)

The phosphates, arsenates, and vanadates of the rare earth metals occur in two structure types. Most of them crystallize in the zircon structure; some of them, salts of the rare earths having larger ions, crystallize in the huttonite and monazite type, respectively. Both types were found in the case of $TbPO_4$. The dimensions of the unit cells of the zircon-type compounds are given. There is no discontinuity of the alteration of the cell dimensions and lattice constants of the arsenates and vanadates with increasing atomic number at the gadolinium salts. $ScPO_4$, $ScAsO_4$, and $ScVO_4$ have zircon structure; $BiPO_4$ exists in a low-temperature modification of huttonite type and still another, hitherto unknown form; $BiAsO_4$ has huttonite structure. (auth)

33940 THE THERMAL CONDUCTIVITY OF NORMAL- AND ORTHO-DEUTERIUM AT THE TEMPERATURE OF LIQUID HYDROGEN. K. Heinzinger, W. Eichenauer, and A. Klemm (Technische Hochschule, Darmstadt, Ger. and Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 18a: 762-4(June 1963). (In German)

The measurement of the relative thermal conductivity difference of normal- and ortho-deuterium at 21.7 ± 1.3°K gave for o-D_2 about a 1.7 ± 0.3% greater thermal conductivity than for n-D_2. In contrast to the ortho-para-hydrogen mixture, for which the relative difference of the thermal conductivity and viscosity at this temperature agree within the limits of error, for the deuterium modifications an important difference exists. This can be explained only partly by the variation of the rotational heat of o-D_2 from zero. (tr-auth)

33941 MOMENTUM DISTRIBUTION AND EXCITATION SPECTRUM OF LIQUID HELIUM. W. Brenig and W. E. Parry (Univ. of California, La Jolla). Z. Physik, 175: 40-53(1963). (In English)

The consistency of recent experimental and theoretical analyses of liquid He^4 was investigated. Further evidence was found for a strong depletion of the zero momentum state. The modifications of a Brueckner-Sawada type approximation implied by this depletion as well as by the existence of a net attraction of the helium atoms are discussed. It was found that a single particle model which does not allow for a sufficient width in the single particle spectral function is incapable of giving the observed excitation spectrum as well as the binding energy of liquid He. Better results were obtained with a single particle model which uses Feynman's energies $k^2/2ms(k)$ instead of the peak energy in neutron scattering. (auth)

33942 DETERMINATION OF SMALL DIFFUSION COEFFICIENTS ON THE BASIS OF THE ABSORPTION OF α-RECOIL RADIATION. W. Biermann and D. Heitkamp (Universität, Gottingen, Ger.). Z. Physik. Chem. (Frankfurt), 37: 137-49(May 1963). (In German)

In the scope of an investigation of the influence of energy-rich radiation on the diffusion rates in metals, the method, introduced by V. Hevesy and Seith, based on the absorption of α-recoil radiation and its applicability were tested, and the self-diffusion in lead between 20 and 85°C was measured. Above 10^{-16} cm^2/sec the measured diffusion coefficients were exactly sufficient, while the reproducibility under 10^{-16} cm^2/sec decreased strongly. The lower limits for measurement of diffusion according to this method lie at 10^{-18} cm^2/sec. (tr-auth)

33943 NMR SPIN-ECHO SELF-DIFFUSION MEASUREMENTS ON FLUIDS UNDERGOING RESTRICTED DIFFUSION. D. E. Woessner (Socony Mobil Oil Co., Inc., Dallas). 7p. (CONF-37-1)

From American Chemical Society Meeting, Dallas, Dec. 1962.

Spin-echo measurements are carried out on self-diffusion of water in geological cores and in aqueous suspensions of silica spheres. Spin-echo measurements of the diffusion of benzene in rubber are also carried out. (T.F.H.)

33944 SCATTERING OF LOW-ENERGY ELECTRONS ON MOLECULES. H. Ehrhardt and U. Erbse (Universität, Freiburg i B.). 5p. (CONF-74-14)

From 11th Annual Conference on Mass Spectrometry and Allied Topics, San Francisco, May 1963.

Crossed beams of electrons and molecular beams are studied at electron energies of 25 to 200 ev. Angular and energy distributions of the emitted electrons are measured as functions of the initial electron and molecular energies. Results for n-heptane are shown as examples. The purpose of the investigations is to examine the assumption of a continuum of states, as opposed to discrete energy states in polyatomic molecular ions. (T.F.H.)

33945 MASS SPECTROMETRIC INVESTIGATION OF THE OXIDATION OF MOLYBDENUM AND TUNGSTEN. Joan B. Berkowitz-Mattuck, Alfred Buechler, John L. Engelke, and Steven N. Goldstein (Arthur D. Little, Inc., Cambridge, Mass.). 30p. (CONF-74-15)

From 11th Annual Conference on Mass Spectrometry and Allied Topics, San Francisco, May 1963.

The oxidation of molybdenum and tungsten was investigated mass spectrometrically at temperatures between 1500 and 2600°K and oxygen pressures between 10^{-4} and 10^{-2} torr. The principal products of oxidation were found to be the gaseous dioxide and trioxide, $MO_2(g)$ and $MO_3(g)$ (M = Mo or W). The trioxide is the more important species at low temperatures; the dioxide is the dominant product at high temperatures. Small amounts of polymeric oxides, $(MO_3)_2(g)$ and $(MO_3)_3(g)$ were formed at the lowest temperatures and highest oxygen pressures. The gaseous oxidation products are not in equilibrium with a solid surface oxide. (auth)

33946 REACTIONS OF XENON WITH CERTAIN STRONG OXIDIZING AGENTS. Gary Gard, Francis B. Dudley, and George H. Cady (Univ. of Washington, Seattle). 5p. (CONF-126-13)

From Conference on Noble Gas Compounds, Argonne, Ill., Apr. 1963.

The reactions of xenon with trifluoromethyl hyperfluorite (CF_3OF), oxygen difluoride (OF_2), fluorine fluorosulfate (FSO_3F), and peroxydisulfuryl difluoride ($S_2O_6F_2$) were studied. The mixture of $S_2O_6F_2$ and Xe had a total pressure of 160 mm at 300°K. As the mixture was heated the pressure increased ideally in proportion to the absolute temperature up to about 500°K. Above 500°K, the rate of increase in pressure was abnormally great. There was no evidence for a reaction involving xenon. Above 560°K in the reaction between xenon and oxygen difluoride the pressure decreased, indicating that chemical combination was in progress. Other reactions are also described. (P.C.H.)

33947 PREPARATION OF RARE GAS FLUORIDES AND OXYFLUORIDES BY THE ELECTRIC DISCHARGE METHOD AND THEIR PROPERTIES. A. V. Grosse, A. D. Kirshenbaum, A. G. Streng, and L. V. Streng (Temple Univ., Philadelphia). 14p. (CONF-126-3)

From Conference on Noble Gas Compounds, Argonne, Ill., Apr. 1963.

The preparation and properties of XeF_4, XeF_6, KrF_4, and xenon oxyfluorides are given. Conditions for preparing the compounds by the electric discharge method are listed. A typical preparation of XeF_6 yielded quantitatively 264 mg of XeF_4 in 6 hr. (P.C.H.)

33948 THE XENON–FLUORINE SYSTEM. Bernard Weinstock, Eugene Weaver, and Charles Knop (Ford Motor Co., Dearborn, Mich.). 18p. (CONF-126-2)

From Conference on Noble Gas Compounds, Argonne, Ill., Apr. 1963.

Investigations were made on the formation of compounds in the F–Xe system. The presence of several compounds was qualitatively monitored by infrared spectroscopy. Special attention is given to the identification of the compound associated with the absorption band at 520 cm^{-1}. Evidence strongly suggests that the compound is XeF_5. The separation of XeF_5 and XeF_6 was effected in a variety of ways. Attempts were also made to demonstrate the existence of XeF_5 by the classical methods of physical chemistry. A hypothetical phase diagram for the Xe–F system is illustrated. (P.C.H.)

33949 PREPARATION AND THERMOMAGNETIC ANALYSIS OF COMPOUNDS OF Ce, Pr, AND Nd WITH Fe HAVING THE APPROXIMATE COMPOSITIONS RFe_7. A. E. Ray (Univ. of Dayton Research Inst., Ohio), K. Strnat, and D. Feldmann. 13p. (CONF-20-12)

From 3rd Rare Earth Conference, Clearwater, Fla., Apr. 1963.

Peritectic compounds of Ce, Pr, and Nd with Fe having the approximate compositions RFe_7 were prepared. Lattice constants for the rhombohedral unit cells and peritectic reaction temperatures are presented. The rhombohedral unit cells are simply related to the unit cell for the $D2_d$-$CuZn_5$ structure. It is suggested that the true compositions may actually be R_2Fe_{15}. Magnetic measurements were performed on samples of the compositions $CeFe_5$, $PrFe_7$, and $NdFe_7$. Only $NdFe_7$ was found to exhibit coupling of the atomic moments at room temperature. The Curie temperatures are 228 (T_c of the major phase in the CeFe alloy), 280, and 326°K, respectively. Magnetization vs. temperature curves measured at 4 and 5 kOe are reported for the Pr and Nd compounds. The moment at 4.2°K is in both cases lower than that at 77.3°, indicating that ferrimagnetic coupling of the Neel type P may exist in these compounds. Magnetization vs. field curves measured at 77.3 and 273.2°K and field strengths up to 5 kOe are shown for both compounds. (auth)

33950 A DIRECT DETERMINATION OF THE ^3H–^3He MASS DIFFERENCE. P. E. Moreland, Jr. and K. T. Bainbridge (Harvard Univ., Cambridge, Mass.). 7p. (CONF-74-13)

From 11th Annual Conference on Mass Spectrometry and Allied Topics, San Francisco, May 1963.

The H^3–He^3 mass difference is measured directly utilizing the high resolving power obtainable with a 50-inch double-focusing mass spectrometer. A value of 19.83 ± 18 $\mu\mu$ (C^{12} = 12) is found for the mass differences of this doublet. A description of the mass spectrometer and measurement techniques used is given. Results obtained for the doublets HD–H^3, HD–He^3, and H_2–D are also presented. (auth)

33951 VIBRATION–ROTATION SPECTRA OF CH_4 AND CD_4 IMPURITIES IN XENON, KRYPTON AND ARGON CRYSTALS. A. Cabana, D. F. Hornig, and G. B. Savitsky (Princeton Univ., N. J.). 47p. (CONF-76-6)

From Symposium on Molecular Structure and Spectroscopy, Columbus, Ohio, June 1963.

The infrared spectra of CH_4 and CD_4, present as substitutional impurities in crystals of argon, krypton, and xenon, were studied at temperatures ranging from 5 to 40°K. Both ν_3 and ν_4 of CH_4 in xenon showed a simple four-line pattern which is consistent with that expected for a slightly hindered rotor. In krypton and argon a fifth line appeared on ν_3, as expected from King's theoretical calculations for a tetrahedral rotor in an octahedral field. In addition, argon showed absorption due to pairs or higher aggregates of CH_4 molecules. The rotational spectrum of CD_4 is much more highly perturbed. Detailed assignments to hindered rotational levels could not be made but the general features are in accord with King's model. The frequencies of the CH_4 and CD_4 absorption bands increase steadily in going from xenon to krypton to argon. This can be accounted for by the decrease in the sizes of the cavities occupied, with corresponding larger repulsive interactions between the CH_4 or CD_4 and the host atoms. (auth)

Organic Chemistry

33952 (TID-19258) A COMPARISON OF EXCITON AND MOLECULAR ORBITAL CALCULATIONS ON $n \rightarrow \pi$ TRANSITIONS. David R. Kearns (California. Univ., Riverside) and M. Ashraf El-Bayoumi (Alexandria Univ., Egypt). [1962]. Contract [AT(11-1)-952]. 32p.

The application of the Exciton and the Molecular Orbital (MO) methods is compared to the calculation of $n \rightarrow \pi^*$

transitions in N-heteroaromatic molecules. A number of the features of the $n \rightarrow \pi^*$ transitions were treated by these two methods including energies of the (n,π^*) states, the intensities of the allowed $n \rightarrow \pi^*$ transitions, the ordering of the allowed and forbidden transitions and singlet-triplet splittings. From a comparison of experiment and theory, it is concluded that the assumption, which is made in the Exciton calculations, that $n \rightarrow \pi^*$ transitions are essentially localized "atomic-like" transitions, is poor initial approximation and leads to a number of incorrect predictions. The assumption that the promoted lone-pair electron is delocalized over the pi-aromatic system appears to be a much better initial approximation, and when the effect of electron repulsion between lone-pair electrons is included in the MO calculations, there is very good agreement between the theoretical predictions and experimental observations on $n \rightarrow \pi^*$ transition in the mono- and polycyclic azines. The relation between MO theory in the one-electron approximation and MO theory in which electron repulsion between the lone-pair electrons is included and is also discussed. (auth)

33953 (TID-19259) LABELING CARBOHYDRATES BY EXPOSURE TO ENERGETIC TRITIUM ATOMS. H. C. Moser, Philip Nordin, and J. K. Senne (Kansas State Univ., Manhattan). [1963]. Contract [AT(11-1)-584]. 7p.

Bombardments with energetic tritium atoms were used to prepare non-specifically labeled carbohydrates. A hot-filament suspended approximately 1.5 cm from the carbohydrate surface (at 77°K) was used to atomize T_2 at pressures of 0.001 to 0.003 mm. Products were purified by recrystallization or paper chromatography. Measurements of the specific activities of the purified carbohydrates indicated that 500 to 900 μC of tritium was incorporated in 100 mg of the bombarded carbohydrates at non-labile positions during 30 minute reactions. (auth)

33954 (TID-19265) REACTIONS OF ENERGETIC HYDROGEN ATOMS WITH SOLID FILMS OF PROPENE AT 77°K. Han Bo Yun and Herbert C. Moser (Kansas State Univ., Manhattan). [1962]. Contract AT(11-1)-584. 11p.

Tritium was used as a tracer to study reactions of hydrogen atoms with solid films of propene at 77°K. A tungsten filament centrally located in a spherical flask was used to atomize hydrogen gas at pressures of 0.5 to 5 μ. Products of reactions were separated by gas chromatography. A fraction of the hydrogen atoms reacted before reaching thermal equilibrium with the film. Products of combination reactions of three different C_3 radicals (s-propyl, n-propyl and allyl) were obtained. S-propyl radicals were most abundant, and when helium gas was used to moderate the hydrogen atoms only s-propyl radicals were produced. Fast, surface reactions of free radicals were indicated. (auth)

33955 DECOMPOSITION OF PHOSPHORIC ACID ESTERS BY MEANS OF METAL IONS IN THE ACID pH RANGE. Eugen Bamann, Heinz Trapmann, and Bernhard Oechsner (Universität, Munich). Arch. Pharm., 295: 663-70(Sept. 1962). (In German)

The catalytic action of Th, Hf, Zr, and Ti ions on the dephosphorylation of monoesters of phosphoric acid was demonstrated in the acid (pH 1-7) as well as in the alkaline range. The activity increases in relation to the electropositive character of the element. The phenyl ester was split more readily than unsubstituted aliphatic esters. Among the homologous series of short-chain aliphatic monoesters, the rate of hydrolysis decreased with increasing chain length. Introduction of electronegative groups in the ester molecule promoted the reaction. Catalysis of dephosphorylation of glycerol-α-, glycerol-β-, and phenyl phosphate by Th at pH 3.9 does not increase in proportion to Th concentration; instead, max activity is obtained at 0.00001M $Th(NO_3)_4$. When the rate of the reaction was determined in relation to substrate concentration, it was evident that substrate Th complexes in the proportion 1:1, as well as 1:2 and 1:3, were present. The catalytic rate decreases with a decrease in this ratio. It is suggested that, at low concentrations of Th salts in the pH range 3 to 4.5, the monomeric form $Th(OH_2)^{2+}$ predominates, while at higher concentrations the predominant complex responsible for catalytic activity is $Th_5(OH)_{12}^{6+}$. (H.H.D.)

33956 SYNTHESIS OF TRITIUM-MARKED DL-CARNITINE AND CROTONIC BETAINE. W. G. Verly, P. A. Flamee, and Ch. J. Fallais (Université, Liège). Bull. Soc. Chim. Belges, 72: 50-9(1963). (EUR-324.f). (In French)

The Wilzbach technique was used to label a quantity of β-hydroxy-γ-aminobutyric acid with tritium. The tritium-labeled substance was methylated and the dl-carnitine obtained purified by chromatography and electrophoresis. The chemical and isotopic yields obtained from this operation were calculated and discussed. The tritium-labeled dl-carnitine was dehydrated in tritium-labeled crotonic betaine which was purified by chromatography. The location of the tritium in these labeled molecules is discussed. (auth)

33957 ELECTROPHILIC ADDITION TO OLEFINS. I. THE STEREOCHEMISTRY OF ADDITION OF DEUTERIUM HALIDES TO ACENAPHTHYLENE. Michael J. S. Dewar and Robert C. Fahey (Univ. of Chicago). J. Am. Chem. Soc., 85: 2245-8(Aug. 5, 1963).

It was found that the addition of deuterium bromide or deuterium chloride to acenaphthylene under polar conditions takes place predominantly cis (74 to 90%), the amount of cis-addition being greater in non-polar solvents. The trans adduct was shown to be a primary product of polar addition, being formed neither by secondary isomerization nor by radical addition. The results rule out a π-complex mechanism. (P.C.H.)

33958 ELECTROPHILIC ADDITIONS TO OLEFINS. II. ADDITION OF DEUTERIUM HALIDES TO INDENE; THE MECHANISM OF ADDITION. Michael J. S. Dewar and Robert C. Fahey (Univ. of Chicago). J. Am. Chem. Soc., 85: 2248-52(Aug. 5, 1963).

The addition of deuterium bromide to indene in methylene chloride or pentane at $-78°$ gives 1-bromo-2-deuterioindane containing 80% of the cis adduct. A mechanism involving intermediate carbonium ion pairs is suggested to account for the available experimental evidence for the polar addition of hydrogen halides to olefins. (auth)

33959 THE UNIMOLECULAR ISOMERIZATION OF METHYL-d_3 ISOCYANIDE. STATISTICAL-WEIGHT INVERSE SECONDARY INTERMOLECULAR KINETIC ISOTOPE EFFECTS IN NONEQUILIBRIUM THERMAL SYSTEMS. F. W. Schneider and B. S. Rabinovitch (Univ. of Washington, Seattle). J. Am. Chem. Soc., 85: 2365-70 (Aug. 20, 1963).

The thermal isomerization of CD_3NC was studied at 230.4° over a range of pressures from 10^{-2} to 10^4 mm. The fall-off corresponds to an enhanced value of the effective number of oscillators relative to CH_3NC. The difference in observed activation energy for the two species is very small (~0). The data were treated on an RRKM quantum statistical model. Calculations were made for various

combinations of detailed assumptions in which vibrations were treated both on a harmonic basis and also with varying assumed degrees of anharmonicity and in which a figure axis rotation was treated both as active and as adiabatic. Various aspects of the calculations are in satisfactory agreement with experiment. The inverse intermolecular secondary isotope effect predicted earlier was found for the first time; k_H/k_D declines from 1.07 at $p = \infty$ to 0.28 at 10^{-2} mm. (auth)

33960 THE EFFECTS OF DEUTERIUM SUBSTITUTION ON THE RATES OF ORGANIC REACTIONS. VIII. THE SOLVOLYSIS OF t-BUTYL-d_1, -d_2, -d_3, -d_6 AND -d_9 CHLORIDES. V. J. Shiner, Jr., B. L. Murr, and G. Heinemann (Indiana Univ., Bloomington). J. Am. Chem. Soc., 85: 2413-16(Aug. 20, 1963).

The solvolysis rate retardations caused by substitution of 1, 2, and 3 deuterium atoms in one methyl group of t-butyl chloride are not quite cumulative; the isotope effect per deuterium increases slightly as the number of deuterium atoms increases. The previously proposed conformational dependence of the β-deuterium isotope effect quantitatively predicts just such a trend. The retardations caused by complete deuteration of 1, 2, and 3 methyl groups are more nearly cumulative. (auth)

33961 THE EFFECTS OF DEUTERIUM SUBSTITUTION ON THE RATES OF ORGANIC REACTIONS. IX. BRIDGEHEAD β-DEUTERIUM IN A CARBONIUM ION SOLVOLYSIS. V. J. Shiner, Jr. and J. S. Humphrey, Jr. (Indiana Univ., Bloomington). J. Am. Chem. Soc., 85: 2416-19(Aug. 20, 1963).

The bicyclic tertiary chloride 11-methyl-11-chloro-9, 10-dihydro-9,10-ethanoanthracene and its -12,12-d_2 and -9,10-d_2 analogs were synthesized and their solvolysis rates measured in 60% aqueous ethanol at 45°. While the -12,12-d_2 analog shows a typical β-deuterium isotope effect for a carbonium ion solvolysis ($k_H/k_D = 1.14$), the bridgehead deuterated analog (-9,10-d_2) exhibits an isotope effect, $k_H/k_D = 0.986$, not appreciably different. It was concluded that the β-deuterium isotope effect is strongly dependent on the spatial orientation of the isotopic bond. This is consistent with the earlier suggestion that hyperconjugative intramolecular transmission of electronic charge is an essential factor in causing β-deuterium-substituted compounds to give slower carbonium ion type reactions than their protium analogs. Inductive interactions seem to cause a much smaller effect, possibly in the opposite direction. (auth)

33962 ACID- AND BASE-CATALYZED HYDROGEN EXCHANGE IN METHYL-SUBSTITUTED INDOLES. B. C. Challis and F. A. Long (Cornell Univ., Ithaca, N. Y.). J. Am. Chem. Soc., 85: 2524-5(Aug. 20, 1963).

The mechanism of acid- and base-catalyzed detritiation of 2-methylindole-3-t and 1,2-dimethylindole-3-t is discussed. In 2-methylindole-3-t the reaction is catalyzed by the hydronium ion and general acids. The observed general acid catalysis strongly suggests that the exchange process in acidic solutions occurs via the A-SE2 mechanism. The most probable explanation for the base catalyzed reaction is an attack of water, acting as a general acid, on the anion of 2-methylindole-3-t formed by proton loss from the nitrogen. (P.C.H.)

33963 STEREOREGULARITY OF POLYMETHACRYLONITRILE. H. Sobue, T. Uryu, K, Matsuzaki, and Y. Tabata (Tokyo Univ.). J. Polymer Sci., Pt. B, 1: 409-11(Aug. 1963).

The stereoregularity of methacrylonitrile polymers obtained by n-butyllithium catalyst and by gamma irradiation in the solid state is reported. Polymethacrylonitrile was converted to polymethyl methacrylate with a yield of about 50%. The Goode J value of polymethyl methacrylate derived from polymethacrylonitrile polymerized by gamma irradiation was 56, which indicates that the polymer has a stereoblock structure. For polymethacrylonitrile obtained with n-butyllithium catalyst, the J value of polymethyl methacrylate derived was also 56. It was concluded that the sterostructure of polymethacrylonitrile polymerized by gamma radiation seem to be DDDLLLDDDLLL, if the stereostructure of the polymers is not different between the polymers molecules and is uniform in a molecule. (P.C.H.)

33964 ORGANO RARE EARTH COMPOUNDS–ORGANO YTTRIUM COMPOUNDS. Y. Okamoto (New York Univ., New York), W. Brenner, J. C. Goswami, B. Rubin, and A. Armington. 5p. (CONF-20-1)

From Rare Earth Conference, Clearwater, Fla., Apr. 1963.

The literature of the preparation and characterization of organo rare earth compounds is reviewed with special emphasis on organo yttrium compounds. The synthesis of tricyclopentadienyl yttrium is described by known methods. A new surprisingly volatile compound dicyclopentadienyl yttrium chloride was obtained from the reaction of anhydrous yttrium trichloride with sodium cyclopentadiene. Pertinent physical and chemical properties of dicyclopentadienyl chloride are discussed. Similar preparations with other rare earth metals are considered. (auth)

Radiation Chemistry and Radiochemistry

Refer also to abstracts 35192, 35193, 35194, 35201, 35202, 35203, 35204, 35205, 35206, and 35207.

33965 (AD-287561) IRRADIATION "FACTOR-DEPENDENCY." SOME VINYL MONOMERS: "OUT-SCATTERING," "IN-SCATTERING" AND NON-UNIFORMITY OF SCANNING BEAM. Radiation Chemistry Laboratory Series Research Report No. 9. (Quartermaster Research and Engineering Center, Natick, Mass.). Nov. 1961. 19p.

Studies were made on the effects of in-scattering and out-scattering of radiation energy on the radioinduced polymerization of styrene containing 1% of various additives. The results indicate a balance between in-scattering and out-scattering when the polymerization is carried out in 1-inch pyrex tubes. The non-uniformity of the electron beam is also reported. (D.L.C.)

33966 (BNL-7045) INTENSITY EFFECTS, PULSED BEAM EFFECTS AND THE CURRENT STATUS OF DIFFUSION KINETICS. Harold A. Schwarz (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract AT(30-2)-GEN-16. 38p. (CONF-81-3)

From Conference on Basic Mechanisms in the Radiation Chemistry of Aqueous Media, Gatlinburg, Tenn., May 1963.

The chemical effects of high intensity radiation are discussed. Some rate constants for radical reactions that have been published are presented. Some new data bearing on the rate of combination of perhydroxyl radicals are: a new species believed to be hydrogen sesquioxide and the intensity dependence in ferrous sulfate solutions. The ferric yields observed when ferrous sulfate is irradiated are ex-

plained in terms of the rate constants presented. The current status of diffusion kinetics is reviewed, and it is concluded that combination of electrons is the major source of molecular hydrogen. The initial radius of the electron distribution in the spurs is estimated to be about 1.5×10^{-7} cm. 42 references. (auth)

33967 (NP-11465(Pt.II)) THE RADIOCHEMICAL MANUAL. PART 2. RADIOACTIVE CHEMICALS. (United Kingdom Atomic Energy Authority. Research Group. Radiochemical Centre, Amersham, Bucks, England). 1963. 81p. $3.50(BIS); 25s.(HMSO).

An outline is given of the principal sources of supply of radioactive chemicals. The characteristics of radioactive chemicals that must be taken into account when tracer experiments are being planned are discussed. These characteristics include the concepts of purity and its determination, the causes of instability and methods of controlling it, and the behavior of minute quantities and very dilute solutions. The elements, carbon, hydrogen, sulfur, phosphorus, iodine, and chlorine, are covered in more detail. The chief methods of preparing labeled compounds are presented in tables. (M.C.G.)

33968 (NYO-10178) DEVELOPMENT OF TRITIUM LABELING OF ORGANIC MATERIALS. Final Report, March 1, 1962 to January 31, 1963. P. M. Yavorsky and E. Gorin (Consolidation Coal Co., Pittsburgh). June 20, 1963. Contract AT(30-1)-2976. 97p.

Studies are reported which define the applicability range of tritium labeling with a tritiating reagent. Data are given which further outline the potential types of organic structures which are susceptible to labeling by the $TH_3PO_4 \cdot BF_3$ reagent. Structures which inhibit the labeling reaction, as well as those which enhance it, are described. There are certain limitations in the application of the method, i.e., some compound types tend to be unstable in the presence of the acidic reagent. These types are outlined. Methods developed for successfully tagging unstable compounds with a minimum formation of byproducts are described. Comparative data are given on tagging with tritiated phosphoric acid and the corresponding BF_3 complex. Methods are outlined for effecting the indirect labeling of materials which are difficult to label directly. A kinetic analysis is given of the rate of labeling of different hydrogen forms in a number of pure aromatic hydrocarbons. The data are used to elucidate the mechanism of the labeling reaction. It is shown that equilibrium exchange labeling can be readily achieved in both aromatic hydrogen positions and hydrogen positions adjacent to a tertiary carbon atom. Nuclear magnetic resonance data on deuterated cumenes are given to show that the tertiary hydrogen positions act as a gate for aliphatic labeling but do not themselves label. It is shown that, by the use of the combination of equilibrium labeling and the kinetics of labeling, it is possible to analyze unknown mixtures to determine their aromatic and tertiary hydrogen content. Application of the procedure to structural characterization of coal hydro oils is given. (auth)

33969 (PA-TR-3078) SELF-DECOMPOSITION OF C^{14}-LABELLED ORGANIC COMPOUNDS: A REVIEW OF THE LITERATURE. Phillip Rochlin (Picatinny Arsenal. Feltman Research Labs., Dover, N. J.). July 1963. 22p. (AD-413093)

The literature on the self-decomposition of C^{14}-labeled organic compounds was reviewed. Factors causing self-decomposition and methods of reducing or minimizing this effect are discussed. Equations are given for calculating absorbed dose, percent decomposition, and G-values. All data were recalculated on a common basis so that they may be compared. In general, no attempt was made to consider the behavior of the various compounds when subjected to different forms of external radiation, as this has been adequately covered in other reviews. (auth)

33970 (TID-19085) RADIATION CHEMISTRY OF ORGANIC SYSTEMS. Annual Report No. 4, January 1, 1962–December 31, 1962. James A. Knight, Jr. (Georgia Inst. of Tech., Atlanta. Engineering Experiment Station). Jan. 28, 1963. Contract AT(40-1)-2490. 40p.

Radiolysis products from the x irradiation of 2,2,4-trimethylpentane and 2,2,4,6,6-pentamethylheptane are identified, and G values are determined. Description of a gas chromatograph with a differential hydrogen flame ionization detector and with both isothermal and linear temperature program operation is given. (N.W.R.)

33971 (TID-19219) KINETICS OF THE γ-RADIATION INITIATED POLYMERIZATION OF ETHENESULFONAMIDE. Richard H. Wiley and Peter Jaeger (Louisville, Ky. Univ. Coll. of Arts and Sciences). [1962]. Contracts AT(40-1)-229 and 2055. 8p.

Data for the rate of gamma-induced polymerization of ethenesulfonamide at 4 to 50°C are reported. The monomer used was recrystallized from ether at −20°C just prior to use. The polymerization was a linear function of time at 50°C for conversions up to 44% and for times up to 64 min. At 24°C there was an increase in the rate after about 30 min when about 17% conversion was reached. At 4°C the rate was 0.00116 moles/l/sec and at 46°C it was 0.00123 moles/l/sec. It was concluded that the initiation mechanism is significantly, if not entirely, ionic with the possibility of some contribution from radical initiation. (M.C.G.)

33972 (AEC-tr-5941) INFLUENCE OF RADIOACTIVE RADIATIONS ON THE FLOCCULATION OF COLLOIDS. Augustin Boutaric and Madeleine Roy. Translated from Compt. Rend., 196: 1020-2(1933). 3p.

Spectrophotometric studies were made on the effects of radon sources on the flocculation of colloids of positive ferric hydrate, negative ferric hydrate, negative arsenic sulfide, negative mastic resin, and positive mastic resin granules. In all cases, the sols with positive granules flocculated faster with irradiation, while the negative sols showed no change, and no dependence on chemical composition was observed. The effect appears to be due to the radon beta rays neutralizing the positive granules, as no effect of radium gamma rays on flocculation was observed. (D.L.C.)

33973 (AEC-tr-5962) CONDENSATION OF RADIOACTIVE CADMIUM AND SILVER ON METAL SURFACES. H. Frauenfelder, O. Huber, P. Preiswerk, and R. Steffen. Translated by A. M. Ehrlich (Oak Ridge National Lab., Tenn.) from Helv. Phys. Acta, 21: 197-8(1948). 4p.

Samples of Cd^{107} made by the (p,n) process with Ag were deposited on Mo wire. When heated in an evacuated space, it was found that less than 0.5% of the evaporated Cd condensed on a metallic surface placed over the wire, but nearly all of the radioactive Ag (the decay product of Cd^{107}) condensed. If the receiving surface is first plated with Ag, about 50% of the radioactive Cd also condenses. By varying the properties of such a surface, it will be possible to measure half lives of mother and daughter substances in radioactive equilibrium without the necessity of chemical separation. (TCO)

33974 EFFECT OF GAMMA RADIATION ON AQUEOUS SOLUTIONS OF (ETHYLENEDINITRILO)TETRAACETIC ACID. H. E. Zittel (Oak Ridge National Lab., Tenn.). Anal. Chem., 35: 1528-31(Sept. 1963).

The effects of gamma radiation on aqueous solutions of EDTA, used as a complexing agent, were studied at various pH's, EDTA concentrations, and radiation levels. These factors all affect the shape of the curve for the amperometric titration used to measure EDTA concentration; however, none significantly affects the sensitivity of EDTA to irradiation. Under all conditions studied, EDTA was degraded by gamma radiation to the extent of $\sim 1.4 \times 10^{-9}$ mmoles per milliliter of solution irradiated per roentgen. The infrared absorption spectrum of an irradiated solution of EDTA was determined. The radiolysis products were not identified with certainty. Xylenol orange, eriochrome black T, and alizarin red S, which are commonly used in EDTA titrations, are fairly insensitive to gamma radiation insofar as visual end point detection is concerned. (auth)

33975 RECOIL CARBON-14 LABELING OF NAPHTHALENE, PHENANTHRENE AND ANTHRACENE UNDER NEUTRON IRRADIATION. Shigeru Oae (Osaka City Univ.), Naomichi Furukawa, Yoshio Otsuji, and Masayuki Hamada. Ann. Rept. Radiation Center Osaka Prefect., 3: 101-2 (1962). (In English)

The preparation and properties of C^{14}-labeled naphthalene, phenanthrene, and anthracene is reported. Naphthalene and phenanthrene were irradiated both in the form of picrate, and in 2-methyl-pyridine solution, and anthracene only as its picrate. The specific activities and radiochemical yields of the re-entry products and of synthesized methylnaphthalenes were calculated. The results indicate that the radiochemical yields in the case of picrates were higher than those of 2-methylpyridine solutions both for naphthalene and phenanthrene. Chemical degradation of the compounds showed that higher distributions of C^{14} in the positions where the localizations of electrons are known to be higher; namely, the α-position of naphthalene and the 9,10 positions of both phenanthrene and anthracene. (P.C.H.)

33976 RADIOLYSIS OF SULFUR IN BENZENE. Wataru Ando, Ken'ichi Sugimoto, and Shigeru Oae. Ann. Rept. Radiation Center Osaka Prefect., 3: 106-8(1962). (In English)

The radiolysis of benzene and sulfur gives thiophenol, diphenyl disulfide, diphenyl sulfide, hydrogen sulfide, hydrogen, and some polymers. The formation of thiophenol and hydrogen sulfide was considered to be initiated by the radiolysis of benzene to give phenyl and hydrogen radicals, which combine with sulfur in the succeeding step. (P.C.H.)

33977 RADIOLYSIS OF THIOPHENOL IN BENZENE. Wataru Ando, Ken'ichi Sugimoto, and Shigeru Oae. Ann. Rept. Radiation Center Osaka Prefect., 3: 109-11(1962). (In English)

The radiolysis of thiophenol in benzene solution was studied. Thiophenol is oxidized to diphenyl disulfide as the radiation energy absorbed in the benzene is transferred to the thiophenol. The effects of the initial concentration of thiophenol and the radiation doses were measured directly, and the first order rate constant was calculated. The relative stability of the S–H and C–S bonds was about 1:200. Radiolysis of diphenyl disulfide or hydrogen sulfide in benzene was found to form thiophenol. (P.C.H.)

33978 RADIATION CHEMISTRY OF AQUEOUS SULFONPHTHALEIN DYE SOLUTIONS. Ken'ichi Sugimoto, Wataru Ando, and Jitsuo Tsurugi. Ann. Rept. Radiation Center Osaka Prefect., 3: 114-16(1962). (In English)

Observations on the effects of radiation on sulfonphthalein dye solutions are presented. The amounts of decomposition of the dyes were obtained by measuring decoloration as a function of irradiation time and initial concentration of the dye itself. It was found that the amount of decoloration increases with increasing initial concentration of the dye. The acid form was found to be more stable under gamma irradiation than the alkaline form. (P.C.H.)

33979 STUDY OF THE SORPTION PROPERTIES OF NEUTRON-IRRADIATED SILICA GEL. V. V. Gromov and Vikt. I. Spitsyn. At. Energ. (USSR), 14: 491-3(May 1963). (In Russian)

Previous studies on the effect of γ radiation on silica gel yielded contradictory results; therefore the changes caused by exposure to γ rays and neutron beam in the sorption capacity of the material, were investigated. The gel, which was washed with HCl and HNO_3 and dried at 170°C, contained 8.4 micromole/m^2 of structural water. It was exposed simultaneously to a 2×10^{12} n/cm^2 sec neutron beam and to γ radiation of about 10^7 r/hr. The duration of the test series was 2.1 and 20 hours. The samples were heated up to 50°C during the exposure. After the irradiation the samples acquired an activity of 1.5 microcurie, caused by the Si^{31} formed. The gel became strongly yellowish, keeping the coloration for more than 5 months. The sorption capacity was measured by comparing the adsorbed Ca^{2+} and methyl blue before and after the irradiation. It was found that the sorption capacity decreased proportionally with the duration of the exposure. The effect was attributed to the irreversible dehydration of the silica gel by the radiation. (TTT)

33980 THERMAL NEUTRON CAPTURE IN CRYSTALLINE DEOXYRIBONUCLEIC ACID. M. Halmann and I. R. Miller (Weizmann Inst. of Science, Rehovoth, Israel). Biochim. Biophys. Acta, 72: 483-7(July 30, 1963). (In English)

The chemical effects of neutron irradiation of DNA were studied using the $P^{31}(n,\gamma)P^{32}$ reaction. About one-half of the P^{32} was found in the form of low-molecular-weight products, and none of the P^{32} was found in the form of phosphate end groups. Physical changes due to radiolytic damage were measured by melting profiles and by determination of viscosity and sedimentation constants. (auth)

33981 KILIANI'S CYANOHYDRIN REACTION AND THE EFFECT OF BACKGROUND RADIATION ENERGY. Nganshou Wai and Sheau-jean Yao. Bull. Inst. Chem. Acad. Sinica, No. 7, 26-34(Jan. 1963). (In English)

The reactions of sugars, such as D-xylose, D-dextrose, fructose, and maltose, with cyanide were studied at different times. The rate of cyanohydrin reaction measured in the space within a wooden box was greater than that in the space within a lead box of 16 cm wall thickness. It may be predicted that the ordinary background radiation energy, cosmic rays approaching the surface of our earth, contributes to the acceleration of the Kiliani's reaction. The consumption of cyanide for sugars (calculated as KCN) under four different conditions was found to be in the following order: Irradiation with 1.0 g of radioactive compound > irradiation with 0.5 g of radioactive compound > storage in wooden box > storage in lead box. The amount of absorbed cyanide (calculated as KCN) for sugar solution that was irradiated with a radioactive compound overlapped the normal demand. (P.C.H.)

33982 INORGANIC MODEL OF CATALASE AND ITS ACTIVITY AFFECTED BY X-RAY RADIATION. Wen-Hwa Tai. Bull. Inst. Chem. Acad. Sinica, No. 7, 35-42(Jan. 1963). (In English)

In an attempt to extrapolate the damaging effect of radiation on enzymes, a model enzyme made from nickel carbon-

ate and tagged with manganese was x irradiated. After 10 min x irradiation (corresponding to about 2700 rads) the catalase activity of the model enzyme was increased to a maximum value. At this point the activity was found to be 88 μl O_2/mg model enzyme. The volume of oxygen evolved from H_2O_2 depended on the quantity of model enzyme. A similarity of excitation by x radiation existed between model enzyme and natural catalase. (P.C.H.)

33983 LIGHT SCATTERING PROPERTIES OF PECTIN AFTER X-RAY IRRADIATION. Yih-Jian Wu. Bull. Inst. Chem. Acad. Sinica, No. 7, 61-72(Jan. 1963). (In English)

After x irradiation, the average molecular weight of orange pectin nitrate changed from 100 to 85.88% within 10 min, 75.96% within 20 min, 72.58% within 30 min, 71.83% within 40 min, and 72.88% within 50 min. That of the citrus pectin nitrate changed from 100 to 90.91% within 10 min, 77.78% within 20 min, and 65.91% within 30 min. Besides the action of acid, alkali, or pectic enzyme, the deesterification reaction may be induced when pectin is x irradiated. (P.C.H.)

33984 EFFECT OF THE DOSE INTENSITY ON THE RATE OF RADIO-OXIDATION OF CYSTINE IN AQUEOUS SOLUTIONS. R. Brdička, Z. Spurný, and A. Fojtík (Inst. of Physical Chemistry and Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Prague). Collection Czech. Chem. Commun., 28: 1491-8(June 1963). (In English)

The decrease of cystine concentration with time determined originally under one dose intensity (I = 33 r/s) was followed under three dose intensities of γ radiation (I = 3.55, 8.3, and 25 r/s). Under each of these intensities the rate of the cystine uptake is proportional to the square root of the cystine concentration, however, the overall rate constants show, contrary to expectation, a proportionality to the square of the dose intensity. This fact as well as the chromatographic analysis of radiolytic products indicates that the originally proposed reaction scheme for radiooxidation of cystine is inadequate, even if it formally accounts for the kinetics of the cystine uptake in irradiated aqueous solutions. A satisfactory reaction scheme fitting the real conditions has not yet been found. (P.C.H.)

33985 RADIATION INDUCED GRAFT COPOLYMERIZATION TO POLY(VINYL ALCOHOL). VI. GRAFTING OF METHYL METHACRYLATE TO PRE-IRRADIATED POLY(VINYL ALCOHOL) FILMS IN THE PRESENCE OF FERROUS IONS. Ichiro Sakurada, Toshio Okada, and Eiko Kugo. Doitai to Hoshasen, 3: 329-43(Sept. 1960). (In Japanese)

The grafting of MMA to pre-irradiated PVA films (Co^{60} γ rays at 0.15 Mr/hr) with the addition of a small amount of iron salts to a solution of the monomer, acetone, and water (14 : 56 : 30) with a graft efficiency of 98% at 22°C was observed. Ferrous ions were more effective than ferric ions. Experimental data showed that the optimum conditions for grafting were: a ferrous ion concentration in the solution of 1.0×10^{-4} mol/l: a pH of 3.5 (no grafting occurred in alkaline solutions); and temperatures between 20 ~ 30°C. The addition of other reducing agents to the iron redox system only decreased the rate of grafting. (OID)

33986 RADIATION INDUCED GRAFT COPOLYMERIZATION TO POLY(VINYL ALCOHOL). IX. THE EFFECTS OF SOLVENT ON THE GRAFTING OF STYRENE TO POLY(VINYL ALCOHOL) FILMS BY GAMMA IRRADIATION. Ichiro Sakurada, Toshio Okada, and Eiko Kugo. Doitai to Hoshasen, 4: 248-55(Sept. 1962). (In Japanese)

Test results obtained from PVA film samples (0.2 mm thick, 2×0.5 cm^2) in methanol, propanol, CCl_4, acetone, and benzene irradiated by a 1000-C Co^{60} source at the rate of 1.1×10^4 r/hr and in ethanol at 9×10^3 r/hr up to total dosage of 2.5×10^5 r at 30°C were tabulated and are discussed. Except in the case with methanol at a higher concentration, little or no accelerating effect on the grafting of styrene to PVA film was observed. This could be attributed by the important role of gel effect played in homopolymerization at a higher solvent concentration. In the case of CCl_4, the highest accelerating effect on the homopolymerization but low grafting rate were observed. The phenomenon was due to the transfer of grafting chains to the solvent molecules. The solvent with a low chain power is a favorable factor in grafting. (OID)

33987 A STUDY OF THE PRIMARY RADICALS FROM THE RADIOLYSIS OF POLYVINYL ALCOHOL BY MEANS OF ELECTRON PARAMAGNETIC RESONANCE (EPR). A. D. Grishina (Inst. of Electrochemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 150: 809-12 (June 1, 1963). (In Russian)

The irradiation of polyvinyl alcohol (PVA) can lead to the formation of the following radicals: $R-CH_2-C^*H-CH_2-R$, $R-CHOH-C^*H-CHOH-R$, $R-CH_2-C^*OH-CH_2-R$, $R-CH_2-CH(O^*)-CH_2-R$, $R-CH_2^*$, and $R-C^*HOH$. The first four radicals lead to cross-linking of the polymer, and the formation of double bonds. The formation of the last two radicals indicates degradation of the polymer. PVA samples were irradiated with Co^{60} γ rays, and a study of the EPR spectra of the sample irradiated at 20 and at −196°C showed the presence of two radicals. The intensities of a triplet line were found to change gradually from a ratio of 1 : 6 : 1 to a ratio of 1 : 2 : 1, as the irradiated PVA sample was heated from 20 to 70°C. The number of radicals fell by a factor of 10. This behavior can be attributed to the formation of the radicals R^*CH_2, which degrades the polymer, and $R-CH_2-CH(O^*)-CH_2-R$, which leads to cross-linking of the polymer. The G yield for the $R-C^*H_2$ radical is 5 ± 0.5 radicals/100 ev. This low yield is explained by the fact that the RC^*H_2 radicals form in pairs and recombine readily. (TTT)

33988 THE EFFECT OF A PRELIMINARY IRRADIATION WITH PROTONS ON THE RATE OF THERMAL DECOMPOSITION OF POTASSIUM PERMANGANATE. V. V. Boldyrev and A. N. Oblivantsev (Tomsk Polytechnic Inst., USSR). Dokl. Akad. Nauk SSSR, 150: 826-8(June 1, 1963). (In Russian)

Samples of $KMnO_4$ were irradiated with 4.5-Mev protons from a cyclotron at doses of 0.06, 1.2, 4.8, and 9.6×10^6 rads. The rate of thermal decomposition of $KMnO_4$ at 218°C was then determined for each of these irradiated samples. The fraction of $KMnO_4$ reacting at 218°C was called α, and was plotted as a function of the time of decomposition τ. The relative change in the reaction rate constant as a function of dose can be expressed by the equation $\lg\alpha/(1-\alpha) = k\tau$ + const. A comparison of the curves showed that a preliminary irradiation with protons has a greater effect on the rate of permanganate decomposition than an x-ray irradiation has at the same absorbed dose. The linear ionization density is greater with protons than with x rays. Hence, the probability for the occurrence of thermal peaks and lattice displacements is greater on absorption of a proton than it is on absorption of an x ray. (TTT)

33989 THE MECHANISM OF THE RADIOLYTIC OXIDATION OF DIVALENT IRON IN AN AQUEOUS, OXYGEN-CONTAINING SULFURIC ACID SOLUTION AT HIGH ABSORBED DOSE. A. K. Pikaev, P. Ya. Glazunov, and Vikt. I. Spitsyn (Inst. of Physical Chemistry, Academy

of Sciences, USSR). Dokl. Akad. Nauk SSSR, 150: 1077-80(June 11, 1963). (In Russian)

$G(Fe^{3+})$ values for 3×10^{-3} and 10^{-2} M solutions of Mohr's salt were determined in 0.4 and 0.07 M H_2SO_4 saturated with air or oxygen. The $G(Fe^{3+})$ values are higher for the oxygen-saturated solution than for the solution saturated with air at dose rates exceeding 10^{22} ev/ml-sec. The addition of 10^{-3} M NaCl to a 3×10^{-3} M solution of Mohr's salt led to a 15% decrease in the $G(Fe^{3+})$ value at a dose rate of 10^{23} ev/ml-sec. An equation was written involving the usual radiolytic products and including the recombination of hydrogen and hydroxyl radicals ($H + OH \rightarrow H_2O$). A value of $3.2 \pm 1.2 \times 10^7$ l/mol-sec was obtained for the ratio of the reaction rate constants K_2K_3/K_{10} for three of the radiolytic reactions. In this case, K_2 was the reaction rate constant for the reaction $Fe^{2+} + OH \rightarrow Fe^{3+} + OH^-$; K_3 was the reaction rate constant for the reaction $H + O_2 \rightarrow HO_2$, and K_{10} was the reaction rate constant for the reaction $H + OH \rightarrow H_2O$. The absolute values of the reaction rate constants were found to be: $K_2 = 2.7 \times 10^8$, $K_3 = 5.3 \times 10^9$, and $K_{10} = 4.5 \times 10^{10}$ l/mol-sec. (TTT)

33990 THE KINETICS OF FORMATION OF CRYSTALLIZATION CENTERS IN THE IRRADIATION OF AMORPHOUS SELENIUM. S. V. Starodubtsev, T. S. Pugacheva, V. M. Mikhaelyan, and V. M. Lenchenko (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Dokl. Akad. Nauk SSSR, 150: 1091-3(June 11, 1963). (In Russian)

The irradiation of glassy or amorphorus selenium led to an increase in the number of crystallization centers N. The reaction was first order at a low dose, but at a high dose, the reaction was of a higher order, and was approximated by the following equation: $N = aD^n$. Here, N is the number of crystallization centers; a = a(r) is the dose rate; D is the irradiation dose, and n = 4 to 5. An increase in the linear growth rate of the crystallization centers was observed with increasing dose rate. Glassy selenium consists of cyclic, polymeric molecules containing 8 to 10^3 individual atoms. Radiation ruptures the polymeric molecules, and allows the formation of crystallization centers. The kinetic equations describing this process give an equation of the following form: $N(t) = Bb(T,P)(D-D_k)(D-D_k)^{i_0}$. Here, B is a constant; b is a term proportional to the linear growth rate of the crystallization center; D is the irradiation dose, and D_k is the dose corresponding to the induction period required for the crystallization center to grow to a certain critical size. The experimental value for i_0 is 4 to 5. (TTT)

33991 PULSE RADIOLYSIS STUDIES. III. ELEMENTARY REACTIONS IN AQUEOUS ETHANOL SOLUTION. Leon M. Dorfman and I. A. Taub (Argonne National Lab., Ill.). J. Am. Chem. Soc., 85: 2370-4(Aug. 20, 1963).

The kinetics of the elementary reactions of two transient species, the hydrated electron and the α-ethanol radical, were observed in irradiated deaerated aqueous ethanol solution using the pulse radiolysis technique. Absolute rate constants at 23° were determined for the reaction of the hydrated electron with a hydrogen ion and for the first-order decay of the electron: $e^-_{aq} + H^+_{aq} = H$, $k_{e_{aq}^- + H^+} = (2.26 \pm 0.21) \times 10^{10}$ M^{-1} sec^{-1}; $e^-_{aq} + H_2O = H + OH^-$, $k_{e_{aq}^- + H_2O} \leq 4.4 \times 10^4$ sec^{-1}. The molar extinction coefficient at 577–579 mμ of the hydrated electron in water, based on $G_{e^-_{aq}} = 2.7$ molecules/100 ev, was determined as: $\epsilon_{577} = (9.7 \pm 1.5) \times 10^3$ M^{-1} cm^{-1}. Experiments with C_2H_5OD in strongly basic D_2O establish that the product of the bimolecular reaction of two hydrated electrons is a molecule of hydrogen: $e^-_{aq} + e^-_{aq} = H_2 + 2OH^-$. The isotopic data also give $G_{e_{aq}^-} = (2.9 \pm 0.3)$ molecules/100 ev in D_2O. The molar extinction coefficient of the α-ethanol radical at 2967 Å was determined as: $\epsilon_{2967} = 240 \pm 45$ M^{-1} cm^{-1}. The absolute rate constant for the bimolecular reaction of two α-ethanol radicals at 23° was determined as: $2k_b = (1.4 \pm 0.4) \times 10^9$ M^{-1} sec^{-1}. (auth)

33992 THE SYNTHESIS OF TRITIUM-LABELED 9,10-OLEIC ACID. K. S. Tenny, S. C. Gupta, R. F. Nystrom, and F. A. Kummerow (Univ. of Illinois, Urbana). J. Am. Oil Chemists' Soc., 40: 172-5(May 1963).

Tritium-labeled 9,10-oleic acid was prepared from stearolic acid by reduction with H^3 gas, in the presence of 5% palladium-on-charcoal catalyst, at room temperature and under partial vacuum. No stearic or elaidic acids were formed. Unreacted stearolic acid was removed by low temperature crystallization from Skellysolve F. The H^3-labeled cis 9,10-oleic acid was prepared with a specificity of greater than 90% of the activity at the 9 and 10 positions. Specific radioactivity of the oleic acid was 1000 mc H^3/g. (TCO)

33993 FORMATION OF FRAGMENT IONS FROM CH_3Te^{125} AND $C_2H_5Te^{125}$ FOLLOWING THE NUCLEAR DECAYS OF CH_3I^{125} AND $C_2H_5I^{125}$. Thomas A. Carlson and R. Milford White (Oak Ridge National Lab., Tenn.). J. Chem. Phys., 38: 2930-4(June 15, 1963).

The relative abundances of the fragment ions that result respectively from the nuclear decays of CH_3I^{125} and $C_2H_5I^{125}$ (I^{125} undergoes electron capture to give Te^{125}) were measured with a specially designed mass spectrometer. The data from both studies are similar and give evidence of the highly destructive nature of the decay: only about 1% of the Te–hydrocarbon ions appear to remain intact in spite of the fact that the ions would be expected to be collected with high efficiency; in both studies a large number of tellurium ions are found with charges as high as 18 and with an average charge of about 9; also in both studies, the singly, doubly, and triply charged carbon ions are found in greater abundance than the hydrocarbon ions. The cause of this extensive ionization and fragmentation is ascribed primarily to a series of Auger processes that occur subsequently to the formation of inner orbital vacancies in Te^{125} as the result of electron capture and internal conversion in the decay of I^{125}. (auth)

33994 ANALYSIS OF MOLECULAR WEIGHT CHANGES AND GEL DATA OF SOME IRRADIATED VINYL POLYMERS. Mitio Inokuti and Malcolm Dole (Northwestern Univ., Evanston, Ill.). J. Chem. Phys., 38: 3006-9(June 15, 1963).

Theoretical equations on gel formation in polymers were applied to the interpretation of data obtained during the irradiation of isotactic and atactic polypropylene, poly-(1-pentene), and poly-(1-hexene). The modified Charlesby–Pinner function calculated for initial values of the M_w/M_n ratio greater than 2 can be made to agree with observation within experimental uncertainties in the case of polypropylene, but in the case of the other two vinyl polymers, the observed discrepancies are probably too great to be explained by experimental error. A G(S) value decreasing at high doses would account for the observed gel data. It is shown that in the pregelation dose range irrespective of the initial molecular-weight distribution and scission to crosslinking ratio, both $P_{w,0}/P_w$ and $P_{n,0}/P_n$ change very nearly linearly with the dimensionless parameter y/y_g where y_g is the number of crosslinks per initial number-average molecule at the gel point. (auth)

33995 MODEL FOR OH-RADICAL STABILIZATION IN ICE AT 77°K UNDER γ IRRADIATION. Seymour Siegel

(Aerospace Corp., Los Angeles). J. Chem. Phys., 39: 390-2(July 15, 1963).

An analytical equation was derived for the stabilization of OH radicals at 77°K as a function of total irradiation dosage. The derivation is based on a purely phenomenological model that invokes the concept of a reactive volume in which the $H + OH \rightarrow H_2O$ reaction has a probability greater than zero; outside this volume the probability is identically zero. The theoretical curve and the experimental results agree very well. (auth)

33996 ELECTRON SPIN RESONANCE SPECTRUM OF XeF IN γ-IRRADIATED XENON TETRAFLUORIDE. J. R. Morton and W. E. Falconer (National Research Council, Ottawa). J. Chem. Phys., 39: 427-31(July 15, 1963).

The radical XeF was detected by means of electron spin resonance in a single crystal of XeF_4 γ irradiated at 77°K. The following hyperfine interaction constants were obtained for magnetic field directions parallel and perpendicular to the Xe−F bond: $F_{\parallel}^{19} = 2649$ Mc, $F_{\perp}^{19} = 540$ Mc, $Xe_{\parallel}^{129} = 2368$ Mc, and $Xe_{\perp}^{129} = 1224$ Mc. The unpaired electron occupies a σ orbital, and it was shown from parameters derived from the respective atomic wavefunctions that the orbital is predominantly F 2p and Xe 5p in character. The experimentally determined g values for XeF were $g_{\parallel} = 1.9740$, $g_{\perp} = 2.1251$. Departures from the free-spin value are interpreted in terms of interaction between the orbital ground state and excited states of the molecule. (auth)

33997 EXCITATION OF π ELECTRONS IN POLYSTYRENE AND SIMILAR POLYMERS BY 20-kev ELECTRONS. N. Swanson and C. J. Powell (National Bureau of Standards, Washington, D. C.). J. Chem. Phys., 39: 630-4 (Aug. 1, 1963).

Excitation of the π electrons in thin films of polystyrene and some similar polymers were observed in the characteristic energy loss spectra of 20-kev electrons scattered at zero angle. The observed energy loss of approximately 7 ev corresponded to the strong uv absorption near 1800 Å in benzene and its derivatives. An energy loss of 6.97 ± 0.10 ev was measured in films of atactic and isotactic polystyrene, styrene ethylene copolymer, and poly 2,3,4,5,5-pentadeuterostyrene, and an energy loss of 7.25 ± 0.15 ev was measured in poly 2,3,4,5,6-pentafluorostyrene. These energy losses appeared as sharp peaks superimposed on a very broad and more intense loss peak with a maximum at 21.3 ± 0.3 ev in all the electron energy loss spectra obtained. The results for the energy loss attributed to the π electrons were correlated with relevant uv absorption data. A discernible decrease in the measured ~7-ev loss occurred during electron bombardment of the specimens, and was attributed to film contamination and breakdown. The angular distribution of the intensity of each loss in isotactic polystyrene about zero scattering angle was also measured. (auth)

33998 GAS-PHASE RADIOLYSIS OF n-BUTANE. R. P. Borkowski and P. J. Ausloos (National Bureau of Standards, Washington, D. C.). J. Chem. Phys., 39: 818-24(Aug. 1, 1963).

The radiolysis of $n\text{-}C_4D_{10}-n\text{-}C_4H_{10}-I_2$ mixtures was investigated in the presence and in the absence of inert gases. Benzene was added in a few experiments. In the direct and in the inert gas sensitized radiolyses, more than 95% of the propane was formed via the hydride transfer reaction: $sec\text{-}C_3H_7^+ + C_4H_{10} \rightarrow C_3H_8 + C_4H_9^+$. Part of the ethane, ethylene, and propylene can be ascribed to hydride transfer reactions involving $C_2H_5^+$, $C_2H_3^+$, and $C_3H_5^+$, respectively. The yield of these fragments relative to that of the $C_3H_7^+$ increases with the recombination energy of the added inert gas. A few photochemical and radiolytic experiments using $CH_3CH_2CD_2CD_3$ were carried out in order to elucidate the mechanism of the molecular detachment processes. It can be calculated from the results that the relative yields of the fragments produced in the direct radiolysis do not exactly agree with those deduced from the mass spectrometric cracking pattern obtained at 70 ev. The discrepancy is largest for the fragments produced at a high appearance potential. The data also indicate that, in the radiolysis, the contribution of neutral excited molecule decomposition may be considerably less important than recently reported by Beck and Niehaus for pressures around 10^{-5} mm Hg. (auth)

33999 ELECTRON SPIN RESONANCE OF IRRADIATED DNA. R. Salovey, R. G. Shulman, and W. M. Walsh, Jr. (Bell Telephone Lab., Inc., Murray Hill, N. J.). J. Chem. Phys., 39: 839-40(Aug. 1, 1963).

The electron spin resonance (ESR) spectra of free radicals formed in the sodium salt of desoxyribonucleic acid (DNA) by 1-Mev electrons were examined. Dry samples were irradiated at ~200°K and examined at 77°K at microwave power levels below ~0.1 mw. At levels below 1 Mrad only a single, rather broad absorption line was seen. At around this dosage, an additional spectrum containing several resolved hyperfine satellites was found. A free radical fragment compatible with the results was $-\dot{C}(CH_3)CH_2-$. This free radical postulated must come from thymine which contains the only methyl group in DNA. (M.C.G.)

34000 ELECTRON SPIN RESONANCE OF A RADICAL IN IRRADIATED SINGLE CRYSTALS OF ITACONIC ACID. Minoru Fujimoto (Clark Univ., Worcester, Mass.). J. Chem. Phys., 39: 846-7(Aug. 1, 1963).

A stable radical detected in single crystals of itaconic acid irradiated by x or γ rays at room temperature is discussed. The electron spin resonance (ESR) spectra are described. The isotopic hyperfine interaction in the observed radical is believed to arise through hyperconjugation. (M.C.G.)

34001 PARAMAGNETIC DEFECTS IN IRRADIATED CaO. Alexander J. Shuskus (United Aircraft Research Labs., East Hartford, Conn.). J. Chem. Phys., 39: 849-50 (Aug. 1, 1963).

Several paramagnetic defects were observed in single crystals of CaO which were subjected to irradiation. The magnetic resonance spectrum was observed at 9.5 kMc/sec. The most prominent defect had axial symmetry and this symmetry axis lay along a principal crystal axis. Trapped holes were the predominant defect center observable by electron paramagnetic resonance. (M.C.G.)

34002 POSITRONIUM DECAY IN CHOLESTERYL ACETATE. George D. Cole and William W. Walker (Univ. of Alabama, University). J. Chem. Phys., 39: 850-1(Aug. 1, 1963).

A study was made of positronium decay in cholesteryl acetate to determine the dependence of the τ_2 lifetime on temperature, particularly in the region of phase transitions. The first change in τ_2 occurred in the interval 63 to 66°C. No visible change was observed in the sample, and, as is indicated by the measuring cycle, this transition was found to be irreversible. The second increase in τ_2 occurred as the temperature was varied from 104 to 111°C. (M.C.G.)

34003 THE ELECTRON SPIN RESONANCE SPECTRA OF γ-IRRADIATED FUMARIC ACID. R. J. Cook, J. R. Rowlands, and D. H. Whiffen (National Physical Lab., Teddington, Middx., Eng.). J. Chem. Soc., 3520-3(July 1963).

The electron spin resonance spectra of an irradiated

crystal of fumaric acid were studied. A radical of the form $R \cdot CH(CO_2H) \cdot CH(CO_2H)$ is the major product and there is a lesser species that appears to be $CH_2(CO_2H) \cdot \dot{C}H(CO_2H)$. Crystal-structure information derived from the spectra suggests that the fumaric acid lies in planes perpendicular to the b-axis of the monoclinic cell with its C–H bonds at an angle of 68° to a twinning plane, which is very easily developed. (auth)

34004 REACTION BETWEEN OXALYL CHLORIDE AND SATURATED HYDROCARBONS INDUCED BY ULTRAVIOLET LIGHT AND γ-RAYS. M. T. Ahmed and A. J. Swallow (Imperial Coll. of Science and Tech., London). J. Chem. Soc., 3918-19(July 1963).

The effects of ultraviolet light and gamma rays on the reactions of oxalyl chloride with cyclohexane, methylcyclohexane, methylcyclopentane, and 2,2,4-trimethylcyclopentane were compared. The results show that the two reactions follow a similar course. This strongly suggests that the formation of colored products does not account for the limited conversions. A lack of correlation between the color of the reaction mixture and the extent of reaction was also noted. (P.C.H.)

34005 DISCUSSION OF THE ELEMENTARY RADIOLYSIS REACTIONS OF METHANE IN THE GASEOUS PHASE. Florence Fayard (Faculté des Sciences, Orsay, France). J. Chim. Phys., 60: 651-8(May 1963). (In French)

An attempt was made to establish a scheme for the radiolysis of methane that takes into consideration both excitation and primary ionization. Sufficient physical data were available to establish a satisfactory balance for the primary reactions, but the secondary reactions are still too poorly known for a complete scheme to be determined. However, it was shown that the numerical G values are of the order of magnitude predicted by such a scheme if it is assumed that the reaction $H + CH_4 \rightarrow CH_3 + H_2$ does not occur. The heavy liquid product observed in the radiolysis can be due to reactions for the insertion of the CH_2 radical or to reactions of the C_3H_5 radical. (tr-auth)

34006 EFFECT OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS OF BENZOQUINONE AND HYDROQUINONE. Catherine Vermeil, Guy Roquet, and Louis Salomon (Institut du Radium, Paris). J. Chim. Phys., 60: 659-66 (May 1963). (In French)

The hydroxyl radicals formed by water radiolysis are responsible for the degradation reactions observed in x or γ irradiation of aqueous solutions of benzoquinone and hydroquinone. The products formed are not stable and are susceptible, in the case of benzoquinone, of inducing chain oxidation reactions. The high yields obtained at high concentrations of benzoquinone do not allow the conclusion that benzoquinone eventually captures electrons with energy below the ionization potential of water. (tr-auth)

34007 RADIOLYSIS OF BENZENE AND 1,3,5-OCTATRIENE-7-OL IN SOLID SOLUTION AT 77°K. Eva Migirdicyan and Sydney Leach (Faculté des Sciences, Orsay, France). J. Chim. Phys., 60: 691-9(May 1963). (In French)

1,3-cyclohexadiene, 5-hydroxyethyl-1,3-cyclohexadiene, and 6-phenyl-5-hydroxyethyl-1,3-cyclohexaethanol were found in solutions of benzene–ethanol irradiated by x or γ rays at 77°K and then heated to room temperature. These compounds are formed by the addition to benzene of radicals formed in the radiolysis of the solvent. Analogous results were observed for solutions of benzene in methylcyclohexane or in methylcyclohexane-isopentane mixtures. An attempt was made to show an opening of the benzene cycle analogous to that observed in the photolysis of solid solutions where a linear substituted triene is formed as the principal product. However, the radiolysis decomposition of 1,3,5-octatriene-7-ol in solid solution at 77°K shows that the opening of the benzene cycle is not easily detectable. (tr-auth)

34008 NMR AND DIELECTRIC STUDY OF POLYACRYLONITRILE. Minoru Terada, Bernadette Lassier, René Bensasson, and Claude Brot (Faculté des Sciences, Orsay, France). J. Chim. Phys., 60: 701-2(May 1963). (In French)

Two types of polyacrylonitrile, prepared by radiopolymerization of the liquid monomer and of the congealed monomer, were prepared. The nuclear magnetic resonance spectra show a large ray common to the two types and, for samples prepared in the solid phase only, a narrow ray superposed on the first, attributable essentially to included molecules of the monomer. The nuclear relaxation and the dielectric study show that there are, in the two types, molecular movements distributed over a wide correlation time range. (tr-auth)

34009 ELECTRONIC EXCITATION OF A JET OF WATER AND DEUTERATED WATER MOLECULES: STUDY BY ELECTRON PARAMAGNETIC RESONANCE OF THE PRODUCTS CONDENSED AT 77°K. Rose Marx, Sydney Leach, and Marcel Horani (Faculte des Sciences, Orsay, France). J. Chim. Phys., 60: 726-31(June 1963). (In French)

In a study of electron paramagnetic resonance (EPR) of the paramagnetic species trapped at low temperatures, starting from a jet of water molecules bombarded by low-energy electrons, the presence of two spectra (A and B) is observed. The radicals formed by radiolysis of both amorphous and polycrystalline ice are studied. In each case, the evolution of the spectra is followed as the samples are reheated after irradiation. Trapped OH radicals are observed in the ice following irradiation, but not in the condensation products of the gaseous jets; in this case, however, their presence in the zone of electron-molecule interaction is verified by their emission spectra. The spectra (A and B) are attributed to $(H_2O)_2^-$ and H_2O respectively. (tr-auth)

34010 RADIOLYSIS OF ADSORBED CO_2. Roger Coekelbergs, André Crucq, Alfred Frennet, Jean Decot, and Lucien Timmerman (Institut Interuniversitaire des Sciences Nucléaires, Brussels). J. Chim. Phys., 60: 891-8(July-Aug. 1963). (In French)

The radiolysis of CO_2 adsorbed on Al by gamma (Co^{60}), beta (Sr^{90}), and x (around 40 kev) radiation is studied. The effects of temperature, dose, and CO_2/solid ratio are described. The G value calculated with respect to the total energy dissipated in the heterogeneous system assumes a maximum value of 0.11. These results can be interpreted only if an energy transfer from the solid to the adsorbed phase is assumed to exist. (tr-auth)

34011 HETEROGENEOUS SYNTHESIS OF AMMONIA INDUCED BY BETA AND GAMMA RADIATION. Roger Coekelbergs, André Crudq, Jean Decot, and Alfred Frennet (Institut Interuniversitaire des Sciences Nucléaires, Brussels). J. Chim. Phys., 60: 899-901(July-Aug. 1963). (In French)

Mixtures of H_2 and N_2 in various proportions are irradiated by beta particles (Sr^{90}) and gamma rays (Co^{60}) in the presence of a great excess of Al. The G value for the synthesis of NH_3, calculated by means of the total energy dissopation in the heterogeneous system, in between 0.5 and 1; it depends on the pressure of N_2. The activation energy between 200 and 600°K is about 0.5 kcal. (tr-auth)

34012 ON THE NATURE OF THE SOLID-PHASE RADIOPOLYMERIZATION OF SOME VINYL MONOMERS. René Bensasson, Annette Bernas, Monique Bodard, and Rose Marx (Faculté des Sciences, Paris). J. Chim. Phys., 60: 950-6(July-Aug. 1963). (In French)

A determination of the radical or ionic nature of the radiopolymerization of some vinyl-derivative polymers is presented. This determination is carried out by two methods: a comparison of the electron paramagnetic resonance spectra of species created by radiochemical and photochemical means; and studying, in the case of acrylonitrile, the effects of O_2 content and electric fields on the reaction rates. (tr-auth)

34013 PREPARATION AND PURIFICATION OF HIGH SPECIFIC ACTIVITY INSULIN-IODINE-131. R. N. Banerjee and K. Gibson (Middlesex Hospital, London). J. Endocrinol., 25: 145-6(Sept. 1962).

High specific activity insulin-I^{131} can be prepared with oxidizing agents, but these methods are associated with chemical damage of the insulin. This can be overcome by a suitable purification technique. A new method of purification of insulin-I^{131} was developed in which the damaged iodinated insulin is removed by buffer elution on a dextran column. In this way, using chloramine T as an oxidizing agent, and dextran column purification, it was possible to prepare insulin-I^{131} with a specific activity of 1 c/mg, the final product containing less than 3% damaged insulin. Crystalline bovine insulin (2.5 μg in 0.025 ml pH 8 borate buffer) and 4.5 mc I^{131} in 0.05 ml sodium hydroxide were mixed with 50 μg chloramine T in 0.025 ml borate buffer for 1 min. The reaction was terminated by adding 120 μg sodium metabisulfite in 0.1 ml buffer. Free I^{131} was removed by dialyzing the iodinated-insulin mixture against distilled water. The iodinated insulin solution was passed through a 1-g Sephadex G-75 column made up with barbitone buffer pH 8.5. The damaged insulin-I^{131} came out in the first 3-ml elute fraction. Purified insulin-I^{131} was collected in later fractions. With chloramine T oxidative system, an iodination efficiency over 50% was achieved. (H.H.D.)

34014 EFFECTS OF HIGH ENERGY IRRADIATION ON POLYPROPYLENE. S. E. Chappell, J. A. Sauer, and A. E. Woodward (Pennsylvania State Univ., University Park). J. Polymer Sci., Pt. A, 1: 2805-18(Sept. 1963).

Isotactic polypropylene (Profax) film samples irradiated in the Pennsylvania State University reactor at ambient temperatures were examined by solvent extraction and infrared absorption techniques. At low irradiation doses, samples annealed (density = 0.909 g/cc at 24°C) prior to irradiation were found to have a lower gel content and a higher concentration of oxidation products than quenched samples (density = 0.899 g/cc at 24°C) irradiated under identical conditions. Similar gel fraction results were obtained for electron irradiated samples of polypropylene. The effects are believed to arise from the accumulation of a greater concentration of free macroradicals in the higher density samples. At higher reactor dosages the irradiation effects in the annealed and quenched films appeared to be about the same. The gel content as a function of dose was found to be independent of the irradiation intensity level over a twofold range. Irradiations were also carried out on high density polyethylene (Marlex 50) pellets at two temperatures, viz, 40 ± 10°C and 150°C. Irradiation at 150°C led to a greater gel content at any given dose. Nuclear magnetic resonance spectra were obtained for molded annealed samples of partially isotactic polypropylene, irradiated at temperatures of 90 to 330°K. The observed shifts in the line narrowing process that occur in the 270 to 330°K region are explained in terms of the decrease in crystallinity and the increasing density of crosslinks that accompany irradiation. (P.C.H.)

34015 TRACER TECHNIQUES FOR THE DETERMINATION OF MONOMER REACTIVITY RATIOS. IV. MONOMER REACTIVITY RATIOS FOR STYRENE-ISOPRENE COPOLYMERIZATION. Richard H. Wiley and Burns Davis (Univ. of Louisville, Ky.). J. Polymer Sci., Pt. A, 1: 2819-30(Sept. 1963).

The ionization chamber-vibrating reed electrometer assay technique was improved in precision (±0.25% average deviation) and used to determine monomer reactivity ratios for the styrene–isoprene copolymerization. Values of r_1 (styrene) = 0.50 (100°) and 0.54 (80°) and r_2 = 1.92 (100 and 80°) were obtained for the radical initiated copolymerization. For γ-irradiation initiation at 22°, r_1 = 0.66 and r_2 = 1.88. For butyllithium initiation, r_1 = 0.03 and r_2 = 5.9. The difference in the radical and γ-radiation initiation values is considered in terms of possible partial ionic character of the radiation initiation process and possible temperature dependence of the reactivity ratios (r_1) over the 22 to 100°C range. The latter indicates a difference in activation energy of 0.8 kcal/mole for the radical to styrene and radical to isoprene propagation steps. (auth)

34016 RADIATION-INDUCED SOLID STATE POLYMERIZATION OF TETRAOXANE. K. Hayashi, H. Ochi, M. Nishiii, Y. Miyake, and S. Okamura (Japanese Assn. for Radiation Research on Polymers, Osaka). J. Polymer Sci., Pt. B, 1: 427-32(Aug. 1963).

The radioinduced polymerization of tetraoxane is reported and compared with that of trioxane. Under gamma irradiation at 80°C and at a dose rate of 2.5×10^4 r/hr, tetraoxane became gradually opaque. After 18 hr irradiation a polymer crystal with the shape of the monomer crystal was obtained at 94% conversion. However, no polymer was obtained in the melt or in solution. The polymerization proceeded at a considerably high rate. The conversion was linear during irradiation and was completed after 20 hr irradiation at 80°C. The rate of polymerization was much larger than the maximum rate for trioxane at 55 to 60°C. A conversion of 100% was easily attained compared to the difficulty in the polymerization of trioxane where a yield of 70 to 80% was attained only in larger crystals. G-values for monomer disappearance in the two monomers at the maximum rate of polymerization were G (tetraoxane), 7×10^4 (100°C) and G (trioxane), 6×10^3 (55°C). (P.C.H.)

34017 EXPLOSIVE DECOMPOSITION OF A MIXTURE OF ETHYLENE AND CHLOROTRIFLUOROETHYLENE IN A Co^{60} GAMMA RADIATION FIELD. P. Colombo, M. Steinberg, and R. N. Chapman (Brookhaven National Lab., Upton, N. Y.). J. Polymer Sci., Pt. B, 1: 435-6(Aug. 1963). (BNL-7101)

Explosive spontaneous decomposition of components at certain radiation conditions was observed during a study on the copolymerization of the ethylene-chlorotrifluoroethylene (CTFE) system by gamma radiation. After a total dose of ~50,000 rad at room temperature and an initial ethylene/CTFE mole ratio of 11.9:1, the system exploded violently (the 14,000 psi rupture disc was broken) with the formation of a considerable quantity of carbon black. Another explosive reaction at the same dose rate (308,000 rad/hr) occurred when the initial concentration of CTFE was reduced approximately 2½ times. It appears from the data that both the concentration of CTFE and the dose rate play a role in initiating the explosion. (P.C.H.)

34018 CRYSTALLINITY OF POLYETHYLENE AS STUDIED BY THERMOLUMINESCENCE. R. H. Partridge

and A. Charlesby (Royal Military Coll. of Science, Shrivenham, Wilts, Eng.). J. Polymer Sci., Pt. B, 1: 439-42(Aug. 1963).

Studies were made on the thermoluminescence of single polyethylene crystals, fused crystals, and bulk polyethylene granules irradiated with gamma rays at −190°C in air. It was concluded that the crystallinity of the specimens rather than the degree of branching, determines the relative importance of the α, β, and γ peaks, since the degree of branching in the polymer chains is unaffected by fusing. It is also noted that the relative importance of the γ and β peaks appears to change, indicating that the two peaks have somewhat different origins. (P.C.H.)

34019 γ-RAY INITIATED COPOLYMERIZATION OF ETHYLENE AND CARBON MONOXIDE. P. Colombo, M. Steinberg, and J. Fontana (Brookhaven National Lab., Upton, N. Y.). J. Polymer Sci., Pt. B, 1: 447-50(Aug. 1963). (BNL-7074)

The monomer reactivity for the copolymerization of ethylene and CO initiated by Co^{60} γ rays is reported. A comparison of previous values for α (the ratio of specific rate constants) was also made. The data yielded a straight line of the slope 1/22.0 (α = 22), indicating that CO monomer adds 22 times as fast as an ethylene monomer to an ethylene free radical chain end. Previous values found for α were 2.0 and 6.8. (P.C.H.)

34020 SOME CONSIDERATIONS ON THE STRUCTURE AND RADIATION CHEMISTRY OF WATER. Róbert Schiller and István Kiss. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 11: 175-83(1963). (In Hungarian)

The variation in the yield of radiolytic products with higher ranges of concentration and with the temperature unexplained as yet by the radical diffusion theory is discussed. It is shown that by considering some structural features of water, both the temperature dependence of the radical yield and the concentration dependence of H_2 production in the entire range of concentration can be interpreted. The results predicted from the relationships thus established agree to orders of magnitude with the measured temperature coefficients of radical yields. Finally some problems concerning the scope of the radical diffusion model are considered. (auth)

34021 THE RADIOCHEMICAL PREPARATION OF POLYSTYROLSULFONES AT VARIOUS TEMPERATURES. PART I. THE REACTION AT ROOM TEMPERATURE (30°C). Jakob Herz, Dieter Hummel, and Christel Schneider (Universität, Cologne). Makromol. Chem., 63: 12-29(1963). (In German)

Copolymers from styrene and sulfur dioxide were prepared at room temperature by Co^{60} γ rays. The products formed have the same composition, one molecule of sulfur dioxide per two styrene units, and the same kinetics of formation over a wide range of concentration as the polystyrenesulfones prepared by radical catalysts. Above 80 mol% SO_2 in the feed there can be observed an additional ionic homopolymerization of styrene in SO_2 solution which becomes more and more important at higher SO_2 concentrations in the feed. The influence of different solvents on both the ionic and the radical polymerization reaction was also studied. (auth)

34022 THE RADIOCHEMICAL PREPARATION OF POLYSTYROLSULFONES AT VARIOUS TEMPERATURES. PART II. THE REACTION AT LOW TEMPERATURES. Jakob Herz, Dieter Hummel, and Christel Schneider (Universität, Cologne). Makromol. Chem., 64: 95-109 (1963). (In German)

Mixtures of styrene and sulfur dioxide were irradiated with Co^{60} γ rays at various temperatures between +30 and −78°C. This led to two completely different polymerization reactions, one radical leading to the formation of polysulfones and the other ionic leading to the formation of pure polystyrene. The ionic part of the reaction was favored by a decrease in the reaction temperature and by an increase of the sulfur dioxide concentration in the feed. The sulfur content of the polysulfones increased with decreasing temperature (30°C: 11.8% S; −78°C: 18.2% S). At room temperature and at −78°C the composition of the polysulfones was independent of the composition of the reaction mixture but in a medium temperature range (0 to −20°C) it increased with SO_2-concentration. These results agreed with the previously proposed kinetic scheme. Studies were also made of the influence of various solvents on the course of the reaction and of the radioinduced behavior of other monomers in SO_2-solution. (auth)

34023 NATURE AND REACTIONS OF THE REDUCING SPECIES IN AQUEOUS SOLUTIONS IRRADIATED WITH γ-RAYS IN THE PRESENCE OF OXYGEN. G. Scholes and M. Simic (Univ. of Durham, Newcastle upon Tyne, Eng.). Nature, 199: 276-7(July 20, 1963).

Reactions and properties of the dehydrogenating species H^α are described when H^α is gamma irradiated in the presence of water. H^α is defined as a simple hydrogen atom, and evidence of its identity as such is presented. (H.M.G.)

34024 BEHAVIOUR OF POLARONS PRODUCED BY THE ACTION OF IONIZING RADIATION IN AQUEOUS MEDIA. Joseph J. Weiss (King's Coll., Newcastle-upon-Tyne, Eng.). Nature, 199: 589-90(Aug. 10, 1963).

Pulse radiolysis was employed in studies of the behavior of polarons produced by ionizing radiation in water. Reactions in the radiolysis of water are reviewed. Chemical evidence of negative polarons is discussed. It is concluded that self-trapped electrons should be designated polarons rather than hydrated electrons. (C.H.)

34025 ULTRASONIC EFFECT ON NEUTRON-IRRADIATED INORGANIC SOLID COMPOUNDS. Nikola Getoff (Inst. for Radium Research and Nuclear Physics, Vienna). Nature, 199: 593-4(Aug. 10, 1963).

Studies on the effect of ultrasonic treatment of neutron-irradiated solid compounds of the same types as K_2SO_4 showed that two processes are in competition, namely, ultrasonic annealing and ultrasonic damage. In the case of neutron-irradiated solid ammonium salts an additional reducing process occurred, caused by the hydrazine that formed owing to the γ radiation and recoil effects in the pile as well as because of the ultrasonic influence. (C.H.)

34026 FORMATION OF ELECTRONS AND OF ATOMIC HYDROGEN IN γ-IRRADIATED ICE. L. Kevan, P. N. Moorthy, and J. J. Weiss (Univ. of Newcastle upon Tyne, Eng.). Nature, 199: 689-90(Aug. 17, 1963).

Ice containing various solutions of acid carbonates, sulfates, and phosphates was subjected to cobalt-60 γ rays at a dose rate of 0.17 Mrads/hr at 77°K. The appearance of hydrogen atoms was found to be quite general in systems containing certain oxyanions. Hydrogen atoms were recognized by their characteristic hyperfine doublet split by 505 gauss. It was suggested that radiation-produced electrons react with a hydrogen ion to produce stable hydrogen atoms. The yields of hydrogen atoms for various solutes are given. (C.E.S.)

34027 THE CLEAVAGE OF THYMINE DIMERS INTO MONOMERS BY IONIZING RADIATION. B. Schmidt, D. Hartmann, K. Grossgebauer, and W. Schumacher. Naturwissenschaften, 50: 473(1963). (In German)

A study was made to determine if the electron-induced cleavage of the thymine dimer into the monomer would be followed by breaking of the pyrimidine ring on subsequent electron irradiation. After irradiation of an aqueous solution of the dimer at room temperature with electrons (200 kr, 34 Mev), it was found by paper chromatography and mass spectrometry that about 40% of the dimer was transformed into the monomer, but less than 2% of the monomer formed was destroyed. Irradiation of solutions of the monomer under the same conditions gave a high cleavage of the monomer in which urea could be detected by the fission product. The fission of dimers by fast electrons must lead to at least partial elimination of the defects produced by dimerization. (J.S.R.)

34028 DECOMPOSITION OF THYMINE DIMERS INTO THYMINE MONOMERS BY X RADIATION. E.-R. Lochmann (Universität, Berlin). Naturwissenschaften, 50: 474-5 (1963). (In German)

The possibility of the transformation of thymine dimers into monomers by x radiation was investigated in vitro and in vivo. Radioactive thymine dimer (~ 1 mC/mmole), produced by UV irradiation of an aqueous solution was used. Solutions were exposed to x-ray doses of 50, 200, 600, and 1200 kr, and the distribution of the radioactivity was determined after paper chromatographic separation. Enterococcus stei, cultivated in medium containing thymine for 3 days, were washed, suspended in water, and exposed to UV irradiation. The cells were exposed to x-ray doses of 600 and 2000 kr. The results showed that the dimer was partially decomposed into the monomer in the in vitro studies. The transformation is dependent on irradiation dose. At the highest doses decomposition of the pyrimidine ring was established. About 12% of the thymine was transformed into the dimer by the UV irradiation in the in vivo studies. No transformation of the dimer into the monomer was detected even after 2000 kr exposure. (J.S.R.)

34029 NOMOGRAPH FOR DETERMINATION OF NEUTRON-INDUCED ACTIVITIES. Philip A. Benson and Chester E. Gleit (Tracerlab, Richmond, Calif.). Nucleonics, 21: No. 8, 148-50(Aug. 1963).

The basis, construction, and use of the nomograph are explained; and the decay data for the nuclides in it are given. (D.C.W.)

34030 PIEZOSPECTROSCOPIC STUDY OF LUMINESCENCE CENTERS IN ALKALI FLUORIDE CRYSTALS ACTIVATED BY HEXAVALENT URANIUM. A. A. Kaplyanskii and N. A. Moskvin. Opt. Spectry. (USSR) (English Transl.), 14: 357-62(May 1963).

From the splitting pattern of the luminescence lines of LiF–U and NaF–U on deformation, the existence of several types of MeF–U luminescence centers was established and their symmetry determined. It is shown that the multipolarity of the transitions in the lines corresponds to electric–dipole, magnetic–dipole, and mixed magnetic–electric dipole radiation. On the basis of the results obtained and the hypothesis that the MeF–U luminescence centers are uranyl in nature, their structure is discussed. (auth)

34031 DENSITY CHANGE AND F-CENTRE FORMATION IN X-RAYED SODIUM CHLORIDE CRYSTALS. H. Paus and K. Thommen (Universität, Bonn). Phys. Letters, 5: 315-16(Aug. 1, 1963). (In English)

The density change of NaCl crystals brought about by uniform coloration with x rays was measured using a hydrostatic flotation method. The irradiation was performed with 140-kev, 10-ma x rays at 23°C. The density change was found to grow in almost the same manner as the F-center concentration in terms of increasing irradiation time. A linear extrapolation of the experimental curve down to irradiation time t = 0 yields a positive density change. This indicates a contribution to the volume expansion arising from those F-centers formed by the rapid process. It seems possible that the rapid coloration also involves the formation of new vacancies. (C.E.S.)

34032 SOME PROBLEMS IN CHEMONUCLEAR TECHNOLOGY. I. CHEMONUCLEAR REACTORS. Anatol Selecki and Jan Bulanda (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Przemysl Chem., 42: 202-6(Apr.-May 1963). (In Polish)

Research in chemonuclear processes is being intensively pursued in the synthesis of oxides of nitrogen from air, hydrazine from ammonia, ethylene glycol from methanol, low-temperature cracking, oxidizing benzene to phenol, and polymerization of ethylene. Of the many sources of radiation such as radioisotopes, accelerators, and reactors, the latter source appears to be by far the most economical in terms of cost per kilowatt hour of available ionizing radiation. Two general types of chemonuclear reactors are discussed: reactors utilizing neutron plus gamma radiations and reactors utilizing the kinetic energy of fission fragments. A large number of radioisotope reactor designs are reviewed. The characteristics, performance figures, advantages, and shortcomings of each reactor are briefly covered. (TTT)

34033 RADIATION-INDUCED CARBOXYLATION REACTIONS OF ALIPHATIC AMINO ACIDS AND MONOCARBOXYLIC ACIDS. J. Liebster, J. Kopoldova, and A. Babicky (Inst. for Biological Research, Czechoslovak Academy of Sciences, Prague). Radiation Res., 19: 551-8(July 1963).

The carboxylation reactions occurring in irradiated aqueous solutions of aliphatic amino acids were investigated for aminobutyric acid, norvaline, valine, norleucine, leucine, and isoleucine. The products of the fixation of $C^{14}O_2$ in these amino acids were identified. The effects of the radiation dose, the concentration and the ratio of amino acid to $C^{14}O_2$ on the yields of glutamic acid from α-aminobutyric acid as well as the optimum conditions for this reaction were determined. An exchange reaction between the carboxyl group of the amino acid and $C^{14}O_2$ was observed. A similar study was made for the aliphatic monocarboxylic acids from C-2 to C-6, and the yields of the dicarboxylic acids formed were compared. An increased fixation of CO_2 was observed with growing chain length. The optimum conditions for the carboxylation of valeric acid were investigated. (auth)

34034 THE EFFECT OF ACIDITY ON THE HYDROGEN YIELD IN GAMMA-IRRADIATED AQUEOUS SOLUTIONS. C. H. Cheek, V. J. Linnenbom, and J. W. Swinnerton (Naval Research Lab., Washington, D. C.). Radiation Res., 19: 636-42(Aug. 1963).

The initial yield of molecular H in γ-irradiated aqueous solutions was measured as a function of acidity in the range from neutral to 10M H_2SO_4. A decrease in H yield with increasing acidity was observed. It was concluded that the gross number of radicals formed per unit absorbed dose is independent of pH. Possible reaction mechanisms are discussed. (C.H.)

34035 RADIATION-INDUCED CHAIN OXIDATION IN AQUEOUS Sb^{III}–Fe^{II} SOLUTION. [PART] II. Niro Matsuura, Yoshima Kurimura, and Masao Takizawa. Rika Gaku Kenkyusho Hokoku, 39: 35-9(1963). (In Japanese)

34036 EFFECTS OF PRE-IRRADIATION WITH γ-RAYS ON THERMAL DECOMPOSITION OF AMMONIUM

TRISOXALATOFERRATE. [PART] III. Yoshikazu Horiguchi and Yokan Nomura. Rika Gaku Kenkyusho Hokoku, 39: 40-3(1963). (In Japanese)

34037 PULSE RADIOLYSIS: FAST REACTION STUDIES IN RADIATION CHEMISTRY. Leon M. Dorfman (Argonne National Lab., Ill.). Science, 141: 493-8(Aug. 9, 1963).

Developments in the determination of absolute rate constants, made possible by the availability of electron accelerators that can deliver a highly intense electron pulse of microsecond duration, are reviewed. Characteristics of the electron pulse and the physical arrangement for irradiation of samples and detection of transient species at Argonne National Laboratory are indicated. Important observations arising from the Argonne technique are discussed. Among these are the primary species in irradiated water, a variety of aromatic and aliphatic free radicals in both water and organic liquids, and one of the primary species formed in the radiolysis of polar organic liquids. Implications of the pulse radiolysis method for future research are presented. (H.M.G.)

34038 RADIOCHEMICAL SEPARATION OF STRONTIUM BY AMALGAM EXCHANGE. Iqbal H. Qureshi and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Talanta, 10: 737-44(July 1963). (TID-17469) (In English)

The radiochemical separation of strontium by an amalgam-exchange technique was critically evaluated with a saturated aqueous solution of potassium chloride as an exchange medium. With an optimized procedure strontium yields of about 34% were obtained, although mineral acids and alkalies above 0.1M decrease the yield considerably because of decomposition of the amalgam. In studies with tracers of 16 different elements, the technique gave considerably better decontamination than the fuming nitric acid procedure. The simple separation can be carried out in 8 min with no special equipment required, while application of the method to fall-out rain-water samples requires about 40 min. The procedure can also be easily adapted to the preparation of a Y^{90}-free source of Sr^{90}. (auth)

34039 ACTION OF γ-RAYS ON AQUEOUS SOLUTIONS OF CARBON MONOXIDE. Y. Raef and A. J. Swallow (Imperial Coll. of Science and Tech., London). Trans. Faraday Soc., 59: 1631-40(July 1963).

Solutions of CO (4.84×10^{-4} M) in 0.1 N H_2SO_4 (oxygen-free) were irradiated with γ rays (~30,000 rad/h) and found to give H with G = 0.95, CO_2 G = 2.6, formaldehyde G = 0.5, glyoxal G = 0.3, and formic acid G = 0.4. Hydrogen peroxide could not be detected. The results are interpreted in terms of a mechanism involving CHO and COOH radicals, some of the products being secondary. The effect of variations in acidity were investigated, a striking observation being that formic acid is produced with G = 44 in alkaline solution. In the presence of ferrous ions (2×10^{-4} 2×10^{-3} M Fe^{2+}, 0.1 N H_2SO_4) no ferric was produced, but in the presence of ferric ions (2×10^{-4} 1×10^{-3} M Fe^{3+}, 0.1 N H_2SO_4) ferrous ions are produced with G = 6.3–6.4. The ratio of the rate constants for the reactions H + HCHO to H + CO (in 0.1 N H_2SO_4) is 14.8 ± 3, of OH + CO to OH + Fe^{2+} (in 0.1 N H_2SO_4) is 3.6 ± 0.5, and of H + CO to H + H^+ + Fe^{2+} (in 0.1 N H_2SO_4) is 2.2 ± 0.3, all at 23°C. (auth)

34040 CHEMICAL EFFECTS OF RADIATIVE THERMAL NEUTRON CAPTURE. PART 12. ANNEALING BY COMPRESSION. T. Andersen and A. G. Maddock (Cambridge Univ., Eng.). Trans. Faraday Soc., 59: 1641-7(July 1963).

Quantitative data on the annealing of recoil damage by compression are reported for K chromate. By studying the effects of various combinations of compression and thermal annealing, it is shown that besides producing a rapid recombination of fragments, compression also accelerated the thermal annealing process. The results suggest that interstitial diffusion processes contribute to the changes in retention. (auth)

34041 STUDIES ON THE PRODUCTION OF S^{35} BY TRIGA MARK-II RESEARCH REACTOR. PART I. RADIOCHEMICAL SEPARATION AND DISCUSSION. Chong-guk Kim. Wonjaryogwon. Yon'gu Nonmum Chip, 2: 35-6(Dec. 1962).

About 2 ~ 3 mC of S^{35} can be obtained by irradiating 10 g of hexachlorobenzene for 20 hr continuously in the TRIGA Mark II reactor now operating in Korea. The neutron flux was about 0.7×10^{12} n/cm^2/sec at the rotary specimen rack and about 4.0×10^{12} n/cm^2/sec at the central thimble. The neutron reaction proposed for the production is $Cl^{35}(n,p)S^{35}$. The proposed separation method gives a yield of 90% in the form of H_2SO_4 and 99% radiochemically pure. (OID)

34042 RADIOLYTIC OXIDATION OF HYDROCARBONS. William Bartok and Peter J. Lucchesi (to Esso Research and Engineering Co.). U. S. Patent 3,099,613. July 30, 1963. Filed Dec. 21, 1959.

Hydrocarbons from C_8 to C_{15} are partially oxidized at moderately high temperatures with molecular oxygen by utilizing ionizing radiation energy to initiate the reaction. The radiolytic partial oxidation is controlled by adjusting the temperature, pressure, and radiation intensity according to the degree of oxidation required. Only moderately high temperatures are employed to prevent conversion of the feed to inorganic products. (C.E.S.)

Raw Materials and Feed Materials

34043 (K-1573) UNIFORMLY REACTIVE URANIUM DIOXIDE FROM A SINGLE OXIDATION-REDUCTION CYCLE. N. C. Orrick, C. G. Jones, C. F. Hale, E. J. Barber, and Karl E. Rapp (Oak Ridge Gaseous Diffusion Plant, Tenn.). Aug. 28, 1963. Contract W-7405-eng-26. 35p.

By use of a modified thermobalance and reactor as the primary experimental tool for sample preparation and evaluation, a process was developed by which parent uranium feed materials of widely variable reactivity and composition may be converted to a uniformly reactive uranium dioxide. Although numerous methods have been devised for improving the gas-solid reactivity of uranium dioxide toward hydrogen fluoride, none has overcome completely the initial variability of the available materials. Oxygen enrichment of uranium dioxide by incomplete reduction or partial reoxidation accompanied by intermediate cooling increased hydrofluorination reactivity by as much as 50 per cent. However, this intentional introduction of uranyl fluoride as an impurity in the uranium tetrafluoride product incurs a "fluorine penalty" in its final conversion to uranium hexafluoride. Furthermore, uranyl fluoride impurity levels of this order cannot be tolerated in uranium tetrafluoride intended for reduction to metal. Complete atmospheric reoxidation following the initial reduction of uranium feed materials to uranium dioxide produced urano-uranic oxide from which a stoichiometric uranium dioxide possessing uniform and much improved reaction characteristics could be made. Gains made available by the process are pointed out and problems remaining to be solved are formulated. (auth)

34044 DUAL CYCLE REFINERY (Engineering Materials). (Mallinckrodt Chemical Works. Uranium Div., Weldon Spring, Mo.). (CAPE-53)

This package contains 63 drawings. The refinery processes uranium concentrates to uranium metal and intermediate compounds. The refinery building area 103 is composed of two major sections: the digestive and the denitration sections. In the digestive section ore concentrates are digested and transferred as a slurry to extraction area 105 where the uranium solution is purified by solvent extraction and returned to the denitration section. The purified uranium solution is denitrated to yield uranium trioxide. Nitrogen oxide vapors, which evolve from all process tanks, are collected and returned by ducts to the nitric-acid-recovery Facility, Area 108. Condensed vapors are returned to the weak nitric acid storage tanks, Area 102, and are again fed to the reconcentrator of the acid recovery plant. (F.E.S.)

34045 MAGNESIUM FLUORIDE RESIDUE PLANT (Engineering Materials). (Mallinckrodt Chemical Works, St. Louis). (CAPE-56)

This package contains 9 drawings. The magnesium fluoride residue plant is designed to recover uranium from magnesium fluoride residues by grinding and leaching processes. Approximately one-half of the uranium in the residue is recovered as metal by a wet grinding and concentrating process. The remainder of the uranium is recovered by leaching with carbonate-permaganate and precipitating with sodium hydroxide to produce sodium diuranate. The uranium metal and the sodium diuranate are dissolved in nitric acid and reprocessed through the refinery. (F.E.S.)

34046 METHOD OF CARBONATE LEACHING URANIUM ORE. Robert A. Koble and Howard W. Goard (to Phillips Petroleum Co.). U. S. Patent 3,099,525. July 30, 1963. Filed Sept. 26, 1960.

A process in which the loss of sodium ion in the carbonate leaching of a uranium ore is reduced and the loss of uranium values with the residual ore is minimized is presented. This is accomplished by providing an improved method of washing residual uranium bearing solutions from the leached ore in the filtration step. The process involves maintaining proper wash solution ratios of the filters and optimum liquid to ore ratios. (C.E.S.)

34047 REDUCTION OF URANIUM OXIDE. Robert J. Teitel (to Dow Chemical Co.). U. S. Patent 3,099,555. July 30, 1963. Filed Aug. 17, 1960.

Uranium oxides, including UO_2, U_3O_8, UO_3, and their mixtures, are heated together with molten magnesium under an inert atmosphere. The excess magnesium is filtered off and the residue is heated with molten aluminum forming an aluminum–uranium alloy. The alloy is filtered off and the uranium is easily separated from the magnesium oxide. Uranium is recovered either as the metal or as a high-uranium–aluminum alloy. (C.E.S.)

Separation Processes

Refer also to abstracts 33430 and 33431.

34048 (DP-808) URANIUM(IV) NITRATE AS A REDUCING AGENT FOR PLUTONIUM(IV) IN THE PUREX PROCESS. Carl S. Schlea, Myron R. Caverly, Hugh E. Henry, and William J. Jenkins (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Apr. 1963. Contract AT(07-2)-1. 20p.

Practical procedures were demonstrated for partitioning plutonium from uranium in the Purex process with hydrazine-stabilized uranium(IV) nitrate as the reducing reagent for plutonium. Typical partitioning results were 0.04–0.2% loss of plutonium to the uranium product and less than 1 wt % uranium in the plutonium product. With uranium(IV) nitrate as a replacement for ferrous sulfamate, most solids in wastes from the Purex process can be eliminated. No undue hazard is expected from the use of hydrazine as the stabilizing agent. (auth)

34049 (DP-826) RECOVERY OF URANIUM FROM ZIRCONIUM–URANIUM ALLOY. Hugh E. Henry (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). May 1963. Contract AT(07-2)-1. 23p.

The STR process developed for recovering uranium from Zr–U alloy was modified so that the process could be used with equipment in the Savannah River separations plant. Performance of the modified process was satisfactory in tests on a miniature scale. (auth)

34050 (HW-SA-3082) SEPARATION OF CERIUM BY ANION EXCHANGE. F. P. Roberts (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 1963. Contract AT(45-1)-1350. 9p. (CONF-157-1)

From American Chemical Society Northwest Regional Meeting, Bellingham, Wash., June 1963.

Cerium can be quantitatively absorbed from HNO_3 solutions on strong base anion exchange resin columns containing 50 to 200 mg PbO_2 per ml of resin, and it can be eluted using dilute HNO_3 or HCl. Distribution coefficients were determined as a function of HNO_3 molarity for Ce^{4+} on Dowex 1-X4 resin. The method was applied to the determination of trace amounts of cerium activity in the Sr^{90} product recovered at Hanford. (D.L.C.)

34051 (TID-18898) RADIOCHEMICAL SEPARATIONS BY AMALGAM EXCHANGE. Iqbal Hussain Qureshi (Michigan. Univ., Ann Arbor). May 1963. Contract AT (11-1)-1143. 84p.

Radiochemical separation procedures were developed for strontium and thallium by amalgam exchange techniques. Radioactive tracers were used to determine the degree of separation of the desired element obtained by this procedure. The simple procedure requires no special equipment and can be carried out in a few minutes. A saturated aqueous solution of potassium chloride was used as an exchange medium for strontium separation. With an optimized procedure, strontium yields of about 34% were obtained although mineral acids and alkalies above 0.1 M decrease the yield considerably due to decomposition of the amalgam. The decontamination obtained by this procedure is considerably better than that obtained by the fuming nitric acid procedure. The procedure takes about 8 minutes for overall separation while application of this method to fallout rain water samples requires about 40 minutes. This procedure can also be easily adapted to the preparation of an Y^{90}-free source of Sr^{90}. An aqueous 0.5 M sodium nitrate system was used for the exchange of thallium. Thallium yields of more than 95% were obtained while the yields of contaminants in most cases were less than 0.1%. The yield is relatively insensitive to interferences from mineral acids, alkalies, and salts except for halogen acids and sulphites. At room temperature the procedure takes about 6 minutes while at 50°C it requires about 4 minutes for overall separation. The separation of thallium in the presence of fission products can be carried out in about 8 minutes with a high degree of purity. This procedure appears to have useful potentials for the separation of short-lived isotopes of thallium and can readily

be modified for the determination of small amounts of thallium in meteorites, rocks, and alloys samples when used in conjunction with neutron activation analysis. (auth)

34052 (EURAEC-634) RETREATMENT OF IRRADIATED FUELS. Quarterly Report No. 11, October 1–December 31, 1962. (Mol, Belgium. Centre d'Etude de l'Energie Nucléaire). Work Performed under United States–Euratom Joint Research and Development Program. Contract 098-62-11RDB. 56p. A translation.

The studies which were made on the selective fixation of chlorides resulting from fission products have shown the existence of a double salt: $NbCl_5-CaCl_2$ which is unstable at 250°C. Neither $ZrCl_4$ nor $NbCl_5$ is fixed by $FeCl_3$. Thermogravimetric tests explained the better reactivity of UO_2 with HF when obtained by ammonia gas reduction rather than by hydrogen reduction. The study of the thermal stability of $UO_3\epsilon$ has confirmed the existence of a $UO_{2.8}$ compound which is stable in the presence of oxygen at 500°C. Hydrofluoridation of U_3O_8 at 500°C permits elimination of practically all fission iodine. The oxidation of UO_2-PuO_2 compounds is much slower as the plutonium content is greater. A high temperature is necessary to obtain complete oxidation. A study was undertaken for the conversion of uranium and plutonium fluorides into oxides, and for their separation and decontamination, based upon the dissolution of fluorides into molten salts and upon the precipitation of oxides obtained by oxidizing and/or reducing treatment. Oxidation and reduction operations were performed on sintered UO_2 in quantities between 2 and 4 kg. In comparison with the tests effected on a smaller scale, it is necessary to operate with smaller concentrations of oxygen in order to prevent a rise in temperature. Conversely, reaction time has to be extended. The reaction is completed when the temperature within the mass becomes homogeneous. The reduction of U_3O_8 by means of ammonia, on the same scale, also requires a longer reaction time. Whereas hydrofluoridation of UO_2 remains a delicate operation, U_3O_8 can be fluoridated in more favorable conditions requiring comparatively shorter reaction times. Fluoridation of UF_4 does not set any particular problem. On the other hand, fluoridation of $UO_2F_2-UF_4$ compounds is forming the subject of further research. The various studies concerning the installation of a hot semi-pilot are carried on. Several changes in the plant for transformation of UO_2 into UO_3 have affected the efficiency in an unfavorable way. The resistance of Corronel 230, Inconel, and Ni-o-nel to nitric vapors and to SF_4 seems to be satisfactory. (auth)

34053 STUDIES ON THE SOLVENT EXTRACTION OF YTTRIUM THENOYLTRIFLUOROACETONATE. George K. Schweitzer and S. Wayne McCarty (Univ. of Tennessee, Knoxville). Anal. Chim. Acta, 29: 56-60(July 1963). (In English)

Studies of extractions of Y from aqueous solution into chloroform, benzene, methyl isobutyl ketone, and mixtures of these solvents, containing thenoyltrifluoroacetone are described. The effects of reagent concentration, added n-butylamine, and added fluoride were investigated. Values of $pH_{\frac{1}{2}}$ and P_c were determined, and identifications of the involved species are suggested. (auth)

34054 ON THE SEPARATION OF RARE EARTHS WITH ION EXCHANGERS. W. Noddack and G. Oertel (Staatliches Forschungsinstitut für Geochemie, Bamberg, Ger.). Z. Anorg. Allgem. Chem., 318: 122-35(Oct. 1963). (In German)

The separation of the rare earths by means of ion exchangers containing sulfonic acid groups and addition of nitrilotriacetic acid as complex-forming agent is described. The separating process, the reaction mechanism, and the relationship between separation effect and experimental conditions are discussed. In particular, the isolation of pure yttrium earths from gadolinite was accomplished by a technical-scale apparatus devised for this purpose. (auth)

34055 INVESTIGATION OF ION EXCHANGE PROCESSES IN HYDROFLUORIC ACID SOLUTIONS. SEPARATION OF RaD, RaE, AND POLONIUM. M. K. Nikitin and G. S. Katykhin. At. Energ. (USSR), 14: 493-4(May 1963). (In Russian)

The separation coefficients of K_d of lead (RaD) and bismuth (RaE) by the anion exchange resin AB-17 × 14 were determined, using K. Kraus's method. The value of K_d for Po was determined from the activity peak of a chromatographic column filled with the same resin. The K_d value for Po was found to be higher than 100. The results obtained differed from those reported by J. Faris (Anal. Chem. 32: 520 (1960)) who found that Pb is better adsorbed from HF solutions on Dowex-1 than Bi. A chromatographic separation method was developed for RaD, RaE, and Po; it involves the displacement of Po anion exchange resin in the form of an undissociated fluoropolonic acid, by nitric acid. The β spectra thus obtained were examined by means of a β spectrometer. (TTT)

34056 THE MECHANISM FOR THE EXTRACTION OF CERIC NITRATE BY TRIBUTYLPHOSPHATE (TBP) FROM A NITRIC ACID SOLUTION. A. V. Nikolaev, A. I. Ryabinin, and Yu. A. Afanas'ev (Inst. of Inorganic Chemistry, Academy of Sciences, Siberian SSR). Dokl. Akad. Nauk SSSR, 150: 820-2(June 1, 1963). (In Russian)

A full description of the $Ce(NO_3)_4-HNO_3-H_2O-$TBP system is presented with isolines for the $Ce(NO_3)_4$ distribution coefficients (K_D equal to 0.95, 1.1, 1.8, and 4.9), and the line of saturation for $Ce(NO_3)_4$ in the aqueous phase. The extraction lines are linear over a wide concentration of ceric nitrate and nitric acid. This behavior indicates that cerium is extracted as $Ce(NO_3)_4$, and not as $H_2[Ce(NO_3)_6]$. There is no direct relationship between the amounts of $Ce(NO_3)_4$ and HNO_3 which are extracted. The data indicates the formation of a solvate having the composition $Ce(NO_3)_4 \cdot 2TBP$. The distribution coefficient for nitric acid does not exceed 0.2 in most cases. The data indicate that ceric nitrate can be successfully extracted by TBP from a 1 to 2M HNO_3 solution. The composition (Ce and HNO_3 contents), and specific gravities are given for the equilibrium aqueous and organic phases. (TTT)

34057 ION EXCHANGE RESIN SEPARATION OF CALCIUM AND STRONTIUM. Eugene A. Breault (Food and Drug Administration, San Francisco). J. Assoc. Offic. Agr. Chemists, 46: 675-6(Aug. 1963).

Calcium and Sr were separated on an Amberlite IR-120 resin column with ethylenediaminetetraacetic acid, and Ca was determined spectrophotometrically and in the presence of ethylenediaminetetraacetic acid. Calcium recovery from the CaEDTA complex was 85% at the 100 μg level. Recoveries of Ca from the CaEDTA complex in the presence of large quantities of EDTA were improved with the addition of Cu chloride. Calcium and Sr were separated on the Amberlite IR-120 column; ammonium EDTA was used to elute the Ca. Recovery of Ca contaminated with 40% Sr was 100%. The remainder of the Sr, approximately 47%, was recovered free of Ca. A total of 86% of the Sr added was found. (auth)

34058 GEM-BIS(DISUBSTITUTEDPHOSPHINYL)ALKANES. II. EXTRACTION OF URANIUM(VI) WITH

BIS(DI-N-HEXYLPHOSPHINYL)METHANE. J. E. Mrochek, J. W. O'Laughlin, H. Sakurai, and C. V. Banks (Ames Lab., Ames, Iowa). J. Inorg. Nucl. Chem., 25: 955-62(Aug. 1963).

The solvent extraction properties of bis(di-n-hexylphosphinyl)methane, HDPM, and $[(C_6H_{13})_2P(O)]_2CH_2$ for uranium(VI) were studied and compared with those of tri-n-octylphosphine oxide, TOPO, $(C_8H_{17})_3P(O)$. In contrast to TOPO, HDPM forms a polymeric-like complex with uranyl compounds in non-polar solvents. Polymer formation is prevented by the use of a polar solvent such as 1,2-dichlorobenzene. The partition equilibria of nitric acid and uranyl nitrate into 1,2-dichlorobenzene solutions of HDPM and TOPO are discussed. The partition data for various mineral acids and the effect of concentration of these acids on the extraction of uranium (VI) are presented. (auth)

34059 STUDIES ON TTA COMPLEXES WITH METAL IONS. II. INVESTIGATIONS OF SOME TETRAVALENT COMPLEXES IN THE SOLID STATE. Y. Baskin and N. S. Krishna Prasad (Argonne National Lab., Ill.). J. Inorg. Nucl. Chem., 25: 1011-19(Aug. 1963).

Single crystals of TTA chelates of tetravalent U, Th, Hf, Zr, Ce, and Pu were prepared. X-ray diffraction data revealed that the compounds are isostructural, with only slight variations in their orthorhombic cell dimensions. Studies were also conducted of the optical properties, infrared absorption spectra, and differential thermal analysis curves of the compounds. (auth)

34060 SEPARATION OF RARE EARTHS BY MEANS OF SMALL COLUMNS OF KEL-F SUPPORTING DI(2-ETHYLHEXYL)ORTHOPHOSPHORIC ACID. E. Cerrai and C. Testa (CISE, Milan). J. Inorg. Nucl. Chem., 25: 1045-50(Aug. 1963).

The tracer level separation of rare earth elements was achieved by using a small column (3 mm ID × 140 mm height) of Kel-F powder (polytrichlorofluoroethylene) loaded with di(2-ethylhexyl)orthophosphoric acid (HDEHP). A suitable column preparation procedure was determined by investigating the Eu-Tb separation. The column was operated at 85 ± 1°C and elution was carried out with a solution of hydrochloric acid having the proper concentration. For the resolution of mixtures containing more than two lanthanide elements the gradient elution method was used. Separations reported are: Eu-Tb, Eu-Gd-Tb-Sm, La-Ce-Pr-Nd-Pm-Sm-Eu, La-Pr-Sm-Eu-Gd-Tb-Dy-Ho-Er-Tm-Yb-Lu, and Tb-Yb. (auth)

34061 SOME ASPECTS OF SYNERGISM IN SOLVENT EXTRACTION. II. SOME DI-, TRI- AND TETRAVALENT METAL IONS. M. Zangen. J. Inorg. Nucl. Chem., 25: 1051-63(Aug. 1963).

Synergistic extraction of trivalent lanthanides and actinides, alkaline earths, and thorium from hydrochloric solutions was studied, using a combination of a monoacidic phosphate or phosphonate ester (the chelating agent) with a neutral organophosphorus compound (the synergist) at varying concentrations in cyclohexane. Of the above, only lanthanides with Z > 64 and Ba failed to show any synergistic phenomena. In general, the synergism was much less pronounced than in the case of U(VI). The basic difference between synergism for U(VI) and for other ions is pointed out, formulas are proposed for the extracted species, and the values of some equilibrium constants are derived. (auth)

34062 EXCHANGE PROPERTIES OF AMMONIUM SALT OF 12-HETEROPOLYACIDS. VI. SORPTION OF CERIUM, RUTHENIUM, ZIRCONIUM AND NIOBIUM ON AMMONIUM PHOSPHOTUNGSTATE AND ISOLATION OF ^{137}Cs FROM AN AGED MIXTURE OF FISSION PRODUCTS. J. Krtil and J. Zemanová (Inst. of Nuclear Research, Rez, Czechoslovakia). J. Inorg. Nucl. Chem., 25: 1069-71 (Aug. 1963).

The sorption of Ce, Ru, Nb, and Zr on NH_4PW and the isolation of Cs^{137} from fission products solution were examined. The sorption of an equilibrium mixture of Zr^{95}-Nb^{95} was found to increase with increasing acidity. The effects of sodium and ammonium salts on the sorption of Ce^{144}, ruthenium nitrate, nitrosylruthenium nitrate, and $Nb^{95}-Zr^{95}$ were also investigated. The results are tabulated. (P.C.H.)

34063 REACTOR FUEL PROCESSING. Volume 6, No. 3. Stephen Lawroski, ed. (Argonne National Lab., Ill.). July 1963. $0.55(GPO) (domestic), $0.70(GPO) (foreign). (One of the Technical Progress Reviews prepared quarterly for the Division of Technical Information, USAEC). 60p.

Developments in reactor fuel processing are reviewed. Topics covered include: commercial aspects of fuel processing, research and development on aqueous processing, research and development on nonaqueous processing, waste disposal, and production of uranium, plutonium, thorium, and their compounds. (N.W.R.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

34064 (CONF-78-5) OPERATING CHARACTERISTICS OF A FAST ELECTROMAGNETICALLY OPERATED GAS VALVE. E. A. Knapp and A. H. Williams (Los Alamos Scientific Lab., N. Mex.). [196?]. Contract [W-7405-eng-36]. 20p. (LADC-5736)

From American Physical Society 1963 Summer Meeting, Buffalo, June 1963.

A fast valve for admitting gas into evacuated systems is described. The valve consists of a gas plenum and a thin metallic diaphragm sealing an O-ring opening that is surrounded by a one-turn coil. The diaphragm is momentarily lifted off the O-ring seat by the magnetic field produced by a fast-rising current in the one-turn coil. A 14-μf capacitor operating at 4 to 6 kv energizes the coil with a period of ~20 μsec. The pressure of deuterium gas released by the valve was measured as a function of time and distance from the valve by a fast ion gauge. The performance of two diaphragms was investigated. A circular diaphragm gave a peak pressure of 70 μ in ~150 μsec at an axial distance of 30 cm with a total gas input of ~1 cc atm. A circular diaphragm with a central stem produced a very sharp gas pulse, rising to 80 μ in ~50 μsec 20 cm from the diaphragm. The latter diaphragm allowed gas inputs of ~0.15 cc atm to be released. In both cases, the geometry of the exit tube determines the angular distribution from the valve (half-width at half-maximum ~25°). The performance of the valve is very reproducible and it is simple to construct. (auth)

34065 (ORNL-TM-617) ENGINEERING ASPECTS OF CONCRETE REACTOR PRESSURE VESSELS. M. Bender (Oak Ridge National Lab., Tenn.). Sept. 4, 1963. Contract W-7405-eng-26. 39p.

The current status of information on the use of prestressed concrete for reactor vessels is summarized. The implications of creep, shrinkage, and undefined thermal and mechanical stresses are discussed in terms of reactor pressure vessel integrity. The importance of temperature limits to the vessel design is brought out. Quality control considerations in the fabrication of prestressed concrete vessels are discussed. Such vessels are seen as a means of circumventing the size limitations of steel pressure vessels and are expected to have unique value in reactor system engineering. (auth)

34066 (PNE-221F) INFILTRATION VELOCITIES AT SEDAN AND SCOOTER CRATERS. Final Report. W. C. Rasmussen (Geological Survey, Denver). Apr. 1963. Project SEDAN. 41p.

Explosive cratering in desert alluvium may be likened to the blow of a giant hammer. The explosion causes crushing and compaction, and reduces the porosity and permeability of the dry alluvium. Infiltration velocities determined with 3 double-ring infiltrometers at 16 sites around Sedan crater and 18 sites in and around Scooter crater when compared to 16 sites on the unaffected flat show decreases in the mean infiltration velocity of 29 to 40 percent, from an average 2.78 inches per hour for the unaffected alluvium, to 1.98 in./hr at Sedan, and 1.58 in./hr at Scooter. Infiltration experiments indicate the relation between infiltration velocity and the other hydrologic properties, porosity, specific yield, specific retention, and permeability. Although all hydrologic properties of the surficial alluvium are adversely affected in the intake, storage, and yield of ground water, the alluvium retains sufficient characteristics to be classed as a good aquifer and a poor aquiclude. Measurements were made principally in the fallback material. Three pits in the plastic zone and one pit in the compacted zone gave infiltration velocities lower than the average for the unaffected alluvium. The statistical sample in the plastic and compacted zones is too small for any conclusion. (auth)

34067 (PNE-230F) NAVAL AERIAL PHOTOGRAPHIC ANALYSIS. F. L. Vuillemot (Naval Radiological Defense Lab., San Francisco). Jan. 1963. Project SEDAN. 52p.

The procedures and results of extensive pre- and postshot aerial photographic coverage by naval aircraft are described and evaluated. Objectives were to use high-performance photo aircraft to document pre- and postshot ground zero area conditions, to provide aerial photographs for immediate onsite use in operations, and to determine the unique advantages, if any, of this type of photographic coverage. One preshot and three postshot photo missions were run over the ground zero area by flights of two supersonic F8U-1P (Crusader) jet aircraft of the Pacific Fleet. During each mission black and white, infrared, and color films were exposed. Missions were initially limited to coverage of the immediate crater area but later expanded in area to include the extensive up-wind and cross-wind base surge deposition area. Results indicated that no particular advantage resulted from use of color and infrared film; black and white film proved quite adequate, at least for the low color-contrast area characteristic of the Nevada Test Site. Interim photointerpretation stereo techniques provided the initial gross crater measurements. More deliberate photogrammetric efforts were later employed to locate crater contours and vertical profiles, relative to the bottom of the crater. The strong correlation of the residual contamination and the highly visible up-wind and cross-wind base surge deposition area is demonstrated. The potential value of a naval aerial photography in such events is discussed within the context of recent technological advances. It is concluded that such naval aerial photographic coverage is of considerable value in the rapid assessment of the gross effects of such large scale nuclear excavation events. (auth)

34068 (PNE-300) SCOPE OF CHEMICAL EXPLOSIVE CRATERING EXPERIMENT. E. Graves, W. R. Wray, and R. B. Pierce (California. Univ., Livermore. Lawrence Radiation Lab.). May 15, 1963. Project PRE-BUGGY. Contract [W-7405-eng-48]. 52p.

A general description is given of the Pre-Buggy chemical explosive experiments. These experiments consisted of a series of single- and multiple-charge detonations designed to refine our knowledge of channel size as a function of charge spacing, and to obtain data on venting of explosion products from a row of spherical charges detonated in alluvium. A basic series of six single-charge detonations and four multiple-charge detonations of five charges in a row was executed in Area 5 of the Nevada Test Site from November 1962 through February 1963. Each charge contained 1,000 pounds of nitromethane with a La^{140} tracer. Preliminary examination of the results indicates that: (1) When charges were spaced at 1.0 single-charge crater radius, the channel depth and width were larger than the diameter and depth of a single-charge crater. (2) Small increases in spacing resulted in considerable reduction of

channel depth and a smaller reduction in width. (3) The channel shape at spacings of 1.5 single-charge crater radii was very uneven. (4) When the ratio of the depth-of-burst to depth-of-crater was about two, the venting of explosion products from a row-charge detonation was less than from single-charge detonations. (auth)

34069 (SC-4922(RR)) ROW-CHARGE CRATERS THROUGH TERRAIN WITH A SINGLE ELEVATION CHANGE (A CONTRIBUTION TO THE PLOWSHARE PROGRAM). L. J. Vortman and L. N. Schofield (Sandia Corp., Albuquerque, N. Mex.). July 1963. Contract AT(29-1)-789. 28p.

In earlier experiments, charge spacing rules were developed for excavating a uniform channel through level terrain. The experiment described was made to determine if those rules were also applicable to terrain with a single elevation change. The spacing rule for a channel with a uniform width was used. Too great an elevation change was used in the first few tests, resulting in a channel which was unacceptably narrow at the end with the higher elevation. For the later tests in which the elevation change was reduced, the spacing rules were found to produce a channel with uniform width throughout. The applicability of the spacing rules to terrain with a single elevation change was verified where the spacing between unequal size charges was the average of the spacing which would have been used had those charges been one of a row in level terrain. (auth)

34070 (TID-4100(1st Rev.) (Suppl.17)) SUPPLEMENTAL INSERT SHEETS FOR ENGINEERING MATERIALS LIST. Richard E. C. Duthie, ed. (Division of Technical Information Extension, AEC). August 1963.

An annotated bibliography containing 22 references on engineering materials is presented. The new engineering materials announced in this supplement are presented in a different format from the materials announced in supplements 13 through 16. Individual drawings by numbers and titles are listed. Each title is followed by an abbreviation identifying the organization which assembled the package of engineering materials. Information is given on valves for high-temperature and high-pressure, hot laboratory equipment, metallurgical equipment and processes, radiation instruments, reactors and associated equipment, particle accelerators, uranium recovery, and mobile gamma irradiators for fruit produce. (N.W.R.)

34071 SPECTROSCOPIC LINE-PROFILE STUDIES OF LONG MAGNETICALLY CONFINED HIGH-CURRENT, STEADY-STATE VACUUM ARCS. J. R. McNally, Jr., and M. R. Skidmore (Oak Ridge National Lab., Tenn.). Appl. Opt., 2: 699-706(July 1963).

Spectroscopic studies of the line profiles of radiating ions in a magnetically confined, high-current, steady-state vacuum carbon arc revealed ion temperatures up to 5,000,000°K in a 4.9-m long arc. The ion temperature is a quadratic function of the distance from the anode in a given arc, but for arcs of different lengths the highest arc temperature is roughly proportional to the arc length. The spectrum line profiles are essentially Gaussian (Doppler shape) for observations transverse to the arc column but in very long arcs are non-Gaussian, and sharper, for axial views. Helium, nitrogen, or argon fed to the arc through the cathode result in pronounced heating of the trapped ions, their transverse temperature being dependent on the charge state of the ion, thus suggesting strong radial electric field heating of the ions. (auth)

34072 SPACE POWERPLANT NEEDS AND SELECTION. D. T. Bernatowicz, D. C. Guentert, and J. L. Klann (Lewis Research Center, Cleveland). Astronaut. Aerospace Eng., 1: No. 4, 22-6(May 1963).

The anticipated maximum requirements for nonpropulsive and propulsive electric power for the period through 1975 is discussed. Criteria for evaluating and selecting space power systems are outlined. Chemical, nuclear, and solar power systems are considered. (C.E.S.)

34073 STATIC POWER CONVERSION FOR SPACECRAFT. Terry W. Koerner (California Inst. of Tech., Pasadena). Astronaut. Aerospace Eng., 1: No. 4, 89-92 (May 1963).

Characteristics of static power conversion systems for medium power levels and problems of matching power sources to the load are discussed. Solar panels, storage batteries, thermoelectric couples, and the thermionic diode are discussed. Current-voltage diagrams are compared and several types of regulators that can be used to achieve the desired load régulation are described. (C.E.S.)

34074 CRYOGENIC STORAGE FOR SPACE ELECTRICAL POWER. William A. Chandler (Manned Spacecraft Center, Houston, Tex.). Astronaut. Aerospace Eng., 1: No. 4, 97-101(May 1963).

Supercritical cryogenic storage for supplying cryogenic reactants in spacecraft is discussed. A set of pressure-enthalpy and temperature-entropy diagrams for cryogenic hydrogen and oxygen are used to illustrate the characteristics of supercritical system operation. (C.E.S.)

34075 STORING THERMAL ENERGY. Edward F. Batutis (General Electric Co., Valley Forge, Penna.). Astronaut. Aerospace Eng., 1: No. 4, 102-3(May 1963).

Thermal-energy storage materials for high-temperature power-conversion systems are considered. The melting point, heat of fusion, and molecular or atomic weights of these materials are investigated. Optimum materials have a heat of fusion greater than 100 whr/lb. (C.E.S.)

34076 SERT AND EARLY ELECTRIC PROPULSION SYSTEMS. J. Howard Childs and Ronald J. Cybulski (Lewis Research Center, Cleveland). Astronaut. Aerospace Eng., 1: No. 4, 112-17(May 1963).

The main objectives of the NASA Space Electric Rocket Tests (SERT) are discussed. The design and performance characteristics of several SERT capsules are also considered. (C.E.S.)

34077 ULTRAVACUUM EQUIPMENT FOR NUCLEAR RESEARCH. Alain Biette. Ind. At., 7: No. 5-6, 123-8 (1963). (In French)

An ultravacuum pumping installation that is easy to control and gives vacua up to 10^{-9} Torr is described. The complete ultravacuum unit, in which each element fulfills a necessary function, consists of the pumping element, the detection element, and the measurement element. The pumping system uses diffusion pumps with a pumping capacity of 1000 l/sec and is described in detail. The detector used is a mass spectrometer helium leak detector of the low-pressure type. Its characteristics are given. The Pirani gage and the Bayard-Alpert gage are the measurement elements. (J.S.R.)

34078 THE THERMOELECTROMAGNETIC PUMP. S. Hufnagel (Technische Hochschule, Munich). Kerntechnik, 5: 286-93(July 1963). (In German)

An electromagnetic pump that is simultaneously designed as a thermoelement so it can produce its own power current, heated either from the outside or from the inside by the pumped material (liquid metal) is described. Such a pump, of which the initial model containing a copper constant ther-

moelement and the operating results are described, appears particularly useful for revolving suitable primary coolants in nuclear reactors since it can operate in a capsule, service-free, and without wear and tear, is partly self-regulating and, at the same time, acts as a heat-transfer agent between the primary coolant and a secondary material current. (auth)

34079 ELECTROMAGNETIC TRANSPORTER FOR NUCLEAR REACTOR. D. Dobryakov, V. Nikolaev, and U. Saulite (Inst. of Physics, Academy of Sciences, Latvian SSR). Latvijas PSR Zinatnu Akad. Vestis, No. 2, 68-74 (1963). (In Russian)

The design of an electromagnetic transport system erected in a vertical channel of a nuclear reactor tank is described. The winding of the system consists of 150 coils divided into two circuits of 72 and 78 coils. The installation is supplied by a three-phase 127/220 v a-c circuit. Electric capacity of the installation is 200 kw. (R.V.J.)

34080 RECENT TOPICS ON THE BUILDINGS FOR HANDLING RADIOISOTOPES. Shoichi Fujii. Radioisotopes (Tokyo), 12: 120-32(May 1963). (In Japanese)

34081 PROCEEDINGS SYMPOSIUM ON ENGINEERING FOR MAJOR SCIENTIFIC PROGRAMS, FEBRUARY 5-6, 1963, GEORGIA INSTITUTE OF TECHNOLOGY. Atlanta, Georgia Institute of Technology, 1963. 198p.

Separate abstracts were prepared for two papers on the VELA-UNIFORM program on underground explosion detection and on the Stanford two-mile linear accelerator. (D.C.W.)

34082 VELA UNIFORM — THE U.S. RESEARCH PROGRAM IN UNDERGROUND NUCLEAR TEST DETECTION. J. P. Ruina (Dept. of Defense, Washington, D. C.). p.19-56 of "Proceedings Symposium on Engineering for Major Scientific Programs." Atlanta, Georgia Inst. of Tech., 1963.

Major aspects of the VELA-UNIFORM program for exploring the detection and identification of long-range seismic signals from earthquakes and explosions are discussed. Important results obtained to date are included. (D.C.W.)

34083 THE TWO-MILE LINEAR ELECTRON ACCELERATOR. Richard B. Neal (Stanford Univ., Calif.). p.57-79 of "Proceedings Symposium on Engineering for Major Scientific Programs." Atlanta, Georgia Inst. of Tech., 1963.

The accelerator and some of its components, subsystems, and techniques are described; and its operational principles are reviewed. Presently foreseen experimental uses of the device are discussed. (D.C.W.)

34084 ON THE OPERATING EXPERIENCE OF STEAM GENERATORS IN THE FIRST POWER REACTOR STATIONS. G. N. Ushakov, V. B. Lytkin, L. A. Kochetkov, V. V. Popov, N. T. Belinskaya, and A. F. Sokolov. 18p. (CONF-69-7). (In Russian)

From Conference on Operating Experience with Power Reactors, Vienna, June 1963.

Construction, operation, and performance of an 18 ton/hour steam generator with two 18-m^2 economizers, a 36-m^2 evaporator, and a 18-m^2 superheater are described, and problems of piping breakdown are discussed. (R.V.J.)

34085 SPACE ENVIRONMENTS AND PROBLEMS OF THEIR SIMULATION. Gottfried M. Arnold (Arnold Engineering Development Center, Arnold Air Force Station, Tenn.). 54p. (CONF-95-1)

From American Nuclear Society Symposium on Space Simulation, Vacuum, Temperature, Radiation, New York, May 1963.

Significant space environments and their effects are summarized and requirements for space simulation and testing of complete spacecraft in space simulation facilities developed. Some current engineering problems in connection with space environment simulation systems and facilities are identified and future trends and test requirements are discussed. (auth)

34086 THE EFFECT OF SYSTEM PARAMETERS ON SPACE ELECTRIC POWER SYSTEM WEIGHTS. C. L. Doughman and F. C. Stump (Westinghouse Electric Corp., Lima, Ohio). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-243, 8p, $1.00. (CONF-97-5)

From Summer Meeting, Los Angeles, June 1963.

Recognition of the possible effects of the electrical conversion and control components on space vehicles using ion-thrust devices resulted in this study being initiated. Parametric data were needed to evaluate the usefulness of this type of propulsion and to realistically determine the limitations of this vital link in space power systems. Examination is made of suitable component designs as to characteristics and limitations based on the predicted state-of-the-art in the near future. Component designs are summarized for three systems meeting specific output requirements at a power level of 1.0 megawatt. (auth)

34087 HIGH-FREQUENCY SUPERSONIC HEATING OF HYDROGEN FOR PROPULSION. Jacques M. Bonneville (Arthur D. Little, Inc., Cambridge, Mass.). New York, American Institute of Aeronautics and Astronautics, 1963, Preprint 63026, 39p. (CONF-10-47)

From Electric Propulsion Conference, Colorado Springs, Colo., Mar. 1963.

The possibility of increasing the specific impulse of hydrogen by supersonic heating is shown on the basis of thermodynamics. The application of high-frequency electric fields to heat the gas permits a control over the heating rates in the nozzle, and results in a reduction in energy losses to walls, electrodes, etc. The efficiencies of the various energy transfer processes are considered in some detail. A simple process of expansion and heating is presented. Results of calculations of heat transfer rates to the nozzle wall are given. A consistent set of electron densities and electric fields are also calculated and presented. Some qualitative results of experimental work previously carried out are included. It is concluded that the process should increase the specific impulse of hydrogen appreciably, in a reasonably efficient manner, and that further experimental work is indicated. (auth)

Heat Transfer and Fluid Flow

Refer also to abstracts 34393, 35103, and 35104.

34088 (AERE-M-1105) INSTABILITIES IN TWO-PHASE FLOW. PRELIMINARY EXPERIMENTS. D. J. Pulling and J. G. Collier (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). July 1963. 13p.

Experiments were performed to study the conditions associated with the production of oscillatory instabilities, when evaporation occurs in two parallel heated channels. The effects of different inlet flow conditions were studied, first using sub-cooled water (at 60°C), and later, using two-phase steam and water mixtures at inlet. Although

these were preliminary experiments, and were of a qualitative nature, some important effects were noted. From these tests it is concluded that a negative slope on the pressure drop/mass flowrate curve is not a necessary condition for producing oscillatory instabilities. This agrees with earlier evidence, and the theoretical predictions of Quandt. Also it appears that when two-phase conditions exist at the inlet to the heated section, no oscillatory instability is likely to occur. (auth)

34089 (CONF-165-1) APPROXIMATE MODELS FOR DISTRIBUTED-PARAMETER HEAT-TRANSFER SYSTEMS. S. J. Ball (Oak Ridge National Lab., Tenn.). [1963]. Contract W-7405-eng-26. 9p.

From 1963 Joint Automatic Control Conference, Minneapolis, June 1963.

The use of dimensionless-parameter frequency response diagrams to determine accuracies of lumped-parameter approximations is demonstrated by two examples: calculation of the heat flux at the surface of a semi-infinite solid due to temperature fluctuations of an adjacent fluid and the response of a counterflow heat exchanger to inlet fluid temperature perturbations. (auth)

34090 (EUR-293.e) DIFFUSIONAL PHENOMENA ASSOCIATED WITH TRANSFER OF MOMENTUM, HEAT AND MASS IN TURBULENT PIPE FLOW. R. Nijsing (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 117p.

An analysis was made on transfer of momentum, heat, and mass in turbulent pipe flow. The analysis was deliberately limited to conditions of established flow and transfer; furthermore only flow past a hydrodynamically smooth wall was considered. On the basis of a relatively simple physical model for the behavior of the fluid close to the wall, a universal heat- and mass-transfer relationship was developed for conditions where the main resistance is situated at the wall. The physical model employed is supported by available experimental evidence on hydrodynamic phenomena close to the wall. The universal heat- and mass-transfer relationship predicts rates of heat and mass transfer which agree well with those obtained by experiment. (auth)

34091 (EUR-348.d) DIE BESTIMMUNG ÖRTLICHER WÄRMEÜBERGANGSZAHLEN AN ROHREN BEI HOHEN WÄRMESTROMDICHTEN. (Methods of Measuring the Local Heat Transfer Coefficients in Tubes with High Heat Fluxes). E. Burck, W. Hufschmidt, and W. Riebold (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 32p.

Two different methods of measuring the local heat transfer coefficients in tubes with high heat fluxes were compared. The temperature of the wetted surface was calculated with the temperature of the unwetted surface, measured either by means of thermocouples or the medium tube wall temperature, which can be calculated by measuring the tube resistance. It is shown that the second method may lead to considerable errors, if local values are determined. The first measuring and evaluation method by means of the exact solution of the differential equation of heat conduction with heat sources and temperature-dependent physical properties of the tube materials was proved by measurements on water-cooled tubes with different tube geometries and materials at heat fluxes up to about 400 w/cm^2. (auth)

34092 (EURAEC-299) AN ADVANCED RESEARCH PROGRAM ON THE APPLICATION OF STEAM–WATER SPRAY TO THE COOLING OF LIGHT WATER REACTORS. CAN 2 Quarterly Progress Report No. 3, January 1 to March 31, 1962. (Centro Informazioni Studi Esperienze, Milan). Apr. 10, 1962. Work Performed under United States–Euratom Joint Research and Development Program, Contract 060-61-7 RDI. 14p. (CISE-R-55)

The influence of the flow conditions at the inlet and outlet of the test section on the critical heat flux was studied. The most interesting result obtained in the experiments was the disappearence, in some cases, of the maxima in the burnout curves. Experiments on the influence of a non-heated insert in the test section on the critical heat flux showed that in some cases a non-heated length of 10 diameters is sufficient to completely uncouple the two heated portions. Assembly of a larger high pressure loop for hydrodynamics experiments with argon-water mixtures in adiabatic conditions was nearly completed. A small auxiliary low-pressure air-water loop was constructed to test a device for measuring the shear stress on the duct wall and a device for measuring the flow rate of the liquid film. Preliminary results are given. Long exposure corrosion tests are in progress in the first corrosion loop. Some Zircaloy-2 specimens were submitted to exposures of more than 3,000 hours. The weight increase of the specimens remained practically steady: no breakaway was observed. (auth)

34093 (EURAEC-658) STATISTICAL METHODS FOR HOT CHANNEL AND HOT SPOT CALCULATION. Quarterly Progress Report, January 1, 1963 to March 31, 1963. (FIAT. Sezione Energia Nucleare, Turin). Apr. 30, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 035-60-11 RDI. 38p. (FN-E-33)

Statistical engineering hot channel and spot factors were evaluated varying the parameters entering in the "spot model" relative to typical reactor conditions. The values of the statistical correction factors given by HYTHEST Code were compared with the non-statistical values given by the conservative method. Simple formulas previously set up in order to obtain values of the correction factors close to those furnished by the Code were utilized: the agreement was found satisfactory. The value of the hot channel factor using the statistical methods depends on the assumed axial number of spots. The conservative non-statistical method is, instead, independent of the number of spots. A thermal-hydraulic model relative to an ORGEL type reactor core was defined and a Monte Carlo Code was programmed to evaluate the engineering hot channel and spot factors of such a core. (auth)

34094 (GEAP-4193(Pt.I)) ANALYSIS OF VARIOUS TYPES OF TWO-PHASE ANNULAR FLOW. PART I. ANNULAR FLOW WITHOUT LIQUID ENTRAINMENT. S. Levy (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Feb. 15, 1963. Contract AT(04-3)-189. 36p.

The various possible types of two-phase annular flow are defined and equations are derived for the boundaries of each type of annular flow. Analytical solutions are presented for the specific case of two-phase annular flow without liquid entrainment. Pressure drop, void fraction, and limits for this kind of flow pattern are obtained and compared with available experimental data. (auth)

34095 (GEAP-4258) HEAT TRANSFER TO SUPERHEATED STEAM. W. A. Sutherland (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). May 1963. Contract AT(04-3)-189. 26p.

The physical property variation of superheated steam differs sufficiently from most other gases to warrant ex-

perimental investigation of heat-transfer performance. Results are reported of measurements made in a uniformly heated circular duct with steam at 1000 psi. The data agree very well with the expression used for design purposes, which is based on information in the literature for heating of other gases as well as steam. (auth)

34096 (HW-70178) FLUID MIXING EXPERIMENTS WITH A WIRE WRAPPED 7-ROD BUNDLE FUEL ASSEMBLY. E. D. Waters (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 3, 1961. Contract [AT(45-1)-1350]. 31p.

The use of a 7-rod bundle nuclear fuel element in a circular coolant tube results in distinct flow sub-channels. To allow maximum power generation in the rod bundle, it is necessary to overcome the effects of unbalance between the heat transfer surface and the coolant flow rates in these subchannels by forcing inter-channel mixing to occur. Spiral wire wraps on the individual rods of the bundle promote such mixing. Experiments were performed to determine the amount of fluid mixing that exists between flow channels within 7-rod bundle fuel elements. A coaxial piping arrangement was utilized to introduce a salt solution into the inner coolant channels of a 7-rod bundle placed in a circular tube while regular water was introduced into the outer coolant channels. The salt concentration was measured in samples of the outer channel stream at various distances along the rod bundle mixing length and the relative salt concentration in these samples was used to describe the effectiveness of 4 to 18 inch pitch wire wraps as coolant mixing promoters. Analytical relations were derived to relate the chemical mixing rates to bulk coolant temperature disparity between the inner and outer channel coolant streams under nuclear heating conditions. In this way, the temperature disparity between the inner and outer coolant streams was predicted as a function of wire wrap pitch. These relations can be combined with pressure drop data published previously to indicate that wire wrap pitches of 10 to 18 inches cause near optimum mixing conditions in seven rod bundles. (auth)

34097 (HW-77303) BOILING BURNOUT EXPERIMENTS WITH 19-ROD BUNDLES IN AXIAL FLOW. E. D. Waters, G. M. Hesson, D. E. Fitzsimmons, and J. M. Batch (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 1963. Contract AT(45-1)-1350. 69p.

Boiling burnout data were obtained for axial flow of water through electrically heated 19-rod bundle test sections in a cylindrical tube at 1,200 psig. The experiments were conducted with five different test sections which utilized heated lengths of 18.5, 19.5, or 76 inches and spacings between rods of 0.015, 0.050, or 0.074 inches as maintained by spiral wire wraps on 12 of the 19 rods. Data were obtained at mass velocities of 500,000 to 5,000,000 lb/hr-ft^2 and at outlet coolant conditions up to 36 wt % steam. At low mass velocities, the data show an appreciable effect of rod spacing on burnout heat flux for the 19-rod bundles. The data are compared with independent data and with existing correlations for burnout heat flux of annular or rectangular heat transfer geometries. (auth)

34098 (NASA-TN-D-1742) A COMPARATIVE ANALYSIS OF CONVECTIVE HEAT TRANSFER IN A NUCLEAR ROCKET NOZZLE. Harvey E. Neumann and Paula J. Bettinger (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). Aug. 1963. 27p.

A detailed analysis of the gas-side heat-transfer coefficient associated with a nuclear rocket nozzle is presented. Predicted heat-flux distributions from conventional turbulent-flow correlations were compared with results from turbulent boundary-layer theory. Effects of initial boundary-layer thickness, radial gradients of free-stream velocity, wall temperature distribution, and nozzle geometry on predicted heat flux are considered. (auth)

34099 (ORNL-TM-602) FABRICATION OF RADIATORS FOR BOILING HEAT-TRANSFER EXPERIMENTS. E. A. Franco-Ferreira (Oak Ridge National Lab., Tenn.). Aug. 23, 1963. Contract W-7405-eng-26. 21p.

Two large heat-transfer devices were built. These units contained 7-ft-long tapered tubes which were attached to vapor and condensate headers. In one unit, a 12-tube finned radiator, high-conductivity fins were attached longitudinally to the tubes by a conbination of welding and brazing. The other unit, a 144-tube unfinned condenser, was fabricated entirely by welding. (auth)

34100 (TID-19249) FLUID FLOW EQUATIONS. R. S. Thurston (Los Alamos Scientific Lab., N. Mex.). Jan. 4, 1960. Reissue, July 19, 1962. Contract [W-7405-eng-36]. 15p.

The basic flow equations (continuity, momentum, and energy) are derived and expressed as a table of influence coefficients, with consistent dimensions to facilitate manipulation of the equations to yield useful relations. Results of some manipulations yielding derivatives of velocity, density, pressure, and enthalpy for any fluid in a constant area flow passage are given and are expressed for a gas with the state equation $P = Z\rho RT$. Expressions relating static temperature, pressure, and velocity to stagnation conditions are included. (auth)

34101 FREE CONVECTION HEAT TRANSFER UP TO NEAR-CRITICAL CONDITIONS. V. E. Holt and R. J. Grosh (Argonne National Lab., Ill.). Nucleonics, 21: No. 8, 122-5(Aug. 1963).

Single- and two-phase free-convection heat transfer to a uniform, impurity-free, semi-infinite fluid in a constant state was measured using described equipment. Nucleate-boiling, film-boiling, and single-phase measurements were made with Pt and H_2O at pressures up to 3900 psi. Expressions derived for the film- and nucleate-boiling heat-transfer coefficients agree well with available data for other fluids. An equation for laminar film boiling from vertical plates was also derived. (D.C.W.)

34102 VAPOR PRESSURES OF RANKINE-CYCLE FLUIDS. G. C. Szego (Inst. for Defense Analyses, Washington, D. C.). Nucleonics, 21: No. 8, 158(Aug. 1963).

The vapor pressure as a function of temperature is given for elements that might be used as working fluids in Rankine-cycle space-power systems. Pb, Bi, Mg, Li, Zn, K, Na, Cs, Rb, S, and Hg are considered; and a region of practical operating pressures (5 to 500 psia) and temperatures (1200 to 2500°R) is superimposed on the plotted values. (D.C.W.)

34103 THE APPLICATION OF THE RECUPERATED BRAYTON CYCLE TO SPACE POWER CONVERSION SYSTEMS. L. W. Norman (AiResearch Mfg. Co. of Arizona, Phoenix). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-220, 36p. $1.00. (CONF-97-2)

From Summer Meeting, Los Angeles, June 1963.

The inherent advantages, component designs, high cycle efficiencies, and radiator characteristics of the recuperated Brayton cycle for space power conversion systems are discussed. The inert monatomic gases used in the cycle would for all practical purposes eliminate gravic

condensing and boiling and corrosion. Various heat sources such as reactors, radioisotopes, and solar energy are considered. A number of performance characteristics are graphically illustrated. (C.E.S.)

34104 ANALYSIS OF GAS-LIQUID FLOW PATTERNS. Earl Quandt (Westinghouse Electric Corp., Pittsburgh). New York, American Inst. of Chemical Engineers, 1963, Preprint 47, 23p. $0.50. (WAPD-T-1547; CONF-129-4)

From Heat Transfer Conference, Boston, Aug. 1963.

Gas-liquid flow in closed ducts is examined from the standpoint of the dominant physical forces acting on the system. Dimensionless criteria are developed in terms of the mixture Froude and Webber numbers for the prediction of the major flow patterns. These theoretical results are compared with the empirical correlation of Baker and are considered to be a significant improvement in the treatment of gas-liquid flow patterns. (auth)

34105 APPROXIMATE METHOD FOR CALCULATING MAGNETOHYDRODYNAMIC BOUNDARY LAYER AND HEAT TRANSFER OF A SLIGHTLY CONDUCTING FLUID PAST A CYLINDRICAL BODY. Hwachii Lien (Avco Research and Advanced Development Div., Wilmington, Mass.) and Hsuan Yeh. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-202, 29p, $1.00. (CONF-97-20)

From Summer Meeting, Los Angeles, June 1963.

An approximate method for the solution of the laminar magnetohydrodynamic boundary layer and heat transfer was developed. This method can be applied to the problem of an incompressible flow past an arbitrarily shaped cylindrical body in the presence of a magnetic field normal to the axis of the cylinder. It can also be used for a compressible case when Howarth-Dorodnitsyn variables are introduced. Based on this method, calculations are made for the case of flow around a circular cylinder. First, the velocity and pressure distributions in the inviscid flow (with a magnetic field) are obtained. These results, then, are used to solve the viscous and thermal boundary layer equations. Detail calculations were made on the influence of the Reynolds number, Prandtl number, Eckert number, and the magnetic interaction parameter on the point of separation, the boundary layer thickness, the shear stress at the wall, the velocity and the temperature profiles, and the rate of heat transfer. (auth)

Materials Testing

Refer also to abstract 33426.

34106 (CONF-80-4) NONDESTRUCTIVE TESTING IN THE CONTROL OF NUCLEAR MATERIALS. R. W. McClung (Oak Ridge National Lab., Tenn.). [nd]. Contract W-7405-eng-26. 26p.

From Institute of Nuclear Materials Management 4th Annual Meeting, Buffalo, June 1963.

A review is presented of the capabilities and limitations of the self-emitted gamma and external radiation methods of measuring the fuel content of nuclear materials. The various applications of each method are discussed. (D.L.C.)

34107 (CONF-112-3) APPLICATIONS OF A PHASE-SENSITIVE EDDY-CURRENT INSTRUMENT. C. V. Dodd (Oak Ridge National Lab., Tenn.). [nd]. Contract [W-7405-eng-26]. 16p.

From National Convention on Nondestructive Testing, Los Angeles, March 1963.

Studies of eddy-current analysis indicated that by special techniques it is possible to decrease or eliminate undesirable lift-off effects and to extend the useful thickness range of eddy-current inspections. Equipment was designed and constructed that demonstrated this both in calibration studies and actual inspection problems. (M.C.G.)

34108 (CONF-166-8) STUDIES IN CONTACT MICRORADIOGRAPHY. R. W. McClung (Oak Ridge National Lab., Tenn.). [nd]. Contract W-7405-eng-26. 13p.

From American Society for Testing Materials 66th Annual Meeting, Atlantic City, June 1963.

A study was made of contact microradiographic techniques for the x-ray evaluation of tin specimens or selected small regions in large specimens. Extraneous absorbers such as air and the film holder were removed to permit the use of low-energy x rays, and high-resolution plates were used which permit magnifications up to 500×. Microradiographs are presented for graphite-coated uranium carbide particles, nickel screen, thin graphite section, and various fibrous materials. It is concluded that the contact microradiographic technique is a very useful tool. (D.L.C.)

34109 (HW-74625) UT-4—AN AUTOMATIC ULTRASONIC TESTER FOR CLOSURES OF HANFORD I AND E FUELS. D. O. Hunter and M. F. Zeutschel (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 1963. Contract AT(45-1)-1350. 37p.

The most likely route for water entry to the core of a Hanford AlSi canned fuel element is through the closures' weld beads and braze layers. An ultrasonic tester (UT-4) was developed to inspect the closures' braze layers for possible water paths. Several test modes were tried during development, but a longitudinal wave system gave the best results. The final product was a tester capable of resolving the first return echoes from a 16 mil or larger diameter defect located 30 mils or more from the exterior surface of the jacket. A testing station built around the UT-4 will automatically measure the defect, pass or reject the fuel element, and record test results. (auth)

34110 (NP-13030) MEDICIÓN DE ESPESORES DE ELEMENTOS COMBUSTIBLES LAMINADOS, EN FORMA NO DESTRUCTIVA. Informe No. 79. (Nondestructive Measurement of Thickness of Rolled Fuel Elements). Report No. 79. Antonio C. Castagnet, Humberto J. Di Gregorio, and Nicholás Moundiroff (Argentina. Comision Nacional de Energia Atomica, Buenos Aires). 1963. 13p.

A nondestructive method for thickness measurements of rolled fuel element coatings and mids is reported which is based upon the absorption of beta rays from the natural uranium contained by the mid. (auth)

34111 (SWRI-1296-6-2) DEVELOPMENT OF NONDESTRUCTIVE TESTING INSTRUMENTATION FOR REACTOR PRESSURE VESSELS. Quarterly Report No. 2, April 1, 1963–July 1, 1963. Warren J. McGonnagle (Southwest Research Inst., San Antonio). July 15, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(11-1)-1243. 62p. (EURAEC-796)

An investigation is being conducted to develop a nondestructive testing technique for measuring the shift in the nil ductility transition temperature of A-212 Grade B steel. A correlation was found between the amount of cold working and magnetoabsorption, thermal conductivity, and ultrasonic attenuation. Magnetoabsorption measurements as a function of cold work in A-212 Grade B steel appear to be very promising. The measurement of the ultrasonic attenuation coefficient in cold work material by a through transmission technique showed a relationship between cold work and the attenuation coefficient. For reactor pressure

vessel applications, the techniques must be modified for measurements from one side. The thermal comparator shows applicability to measuring the level of cold work in A-212 Grade B steel. One limitation of this technique as presently used is that the surface condition affects the results. It appears that all three of the techniques evaluated have potential for determining the level of cold work in A-212 Grade B steel. Further work must be done on each technique to refine the measurements and determine their sensitivity and resolution. (D.L.C.)

34112 (TRG-Report-170) HANDLING FACILITIES FOR THE OPERATION OF THE INSPECTION PROGRAMME ON CALDER AND CHAPELCROSS REACTOR PRESSURE VESSELS. J. Gillies (United Kingdom Atomic Energy Authority. Reactor Group, Culcheth, Lancs, England). Nov. 14, 1961. 17p. (NPCC-MWP(S)/P.219; NP/R.206)

An outline is presented of the testing specification for specimens from the Calder and Chapelcross pressure vessel steel inspection programme. A description is given of the facilities available at Culcheth Reactor Materials Laboratory for mechanical testing and metallography, and details of shielded transport flasks are included. (auth)

34113 (TRG-Report-576) COMPARISON OF FRACTURE DATA FOR TWO FAILED VESSELS. H. G. Vaughan (United Kingdom Atomic Energy Authority. Reactor Group, Culcheth, Lancs, England). May 7, 1963. 9p. (NPCC-MWP(S)/P(63)35)

Notch ductility data were established on pieces of two failed vessels supplied by N.R.L., United States. Both vessels failed under roughly the same stress and temperature conditions during pneumatic tests, but one failed with a shear fracture and the other failed with a brittle or cleavage fracture. Drop weight, low blow, Charpy, and crack arrest data predict this difference in fracture behavior, but standard Charpy tests do not. (auth)

34114 PROCEEDINGS OF THE THIRD ANNUAL SYMPOSIUM ON NONDESTRUCTIVE TESTING OF AIRCRAFT AND MISSILE COMPONENTS, FEBRUARY 27, 28, MARCH 1, 1962, SAN ANTONIO, TEXAS. Sponsored by South Texas Section of The Society for Nondestructive Testing, Inc. and Southwest Research Institute. 282p.

Fifteen papers were presented including topics on in-motion radiography, aerojet high voltage radiographic facility, microfocus x-ray techniques, radiography techniques, plan view scanning in eddy current nondestructive testing, effect of time and temperature exposures on conductivity and mechanical properties of aluminum alloys, eddy current testing of small diameter tubing, defect discrimination in automatic multiple transducer inspection systems, r-f spectroscopy, surface wave phenomena in ultrasonics, manned spacecraft center facilities, defect geometry and material microstructure, evaluation of Fokker bond tester system, ultrasonic inspection of materials, and ultrasonic properties of solid propellant binders. A separate abstract was prepared for "Eddy Current Testing of Small Diameter Tubing." Two papers were previously abstracted in NSA (16: 8876 and 17: 5980). (C.E.S.)

34115 EDDY CURRENT TESTING OF SMALL DIAMETER TUBING. R. C. Holt (Knolls Atomic Power Lab., Schenectady, N. Y.). p.119-28 of "Proceedings of the Third Annual Symposium on Nondestructive Testing of Aircraft and Missile Components, February 27, 28, March 1, 1962, San Antonio, Texas." (TID-15249)

The theoretical parameters for eddy current testing of small-diameter thin-wall tubing were evaluated. It is found that frequencies of 0.02 to 3 times the ideal frequency can produce acceptable results. Phase discrimination, based upon elimination of dimensional response, is detrimental to crack detection. Magnetic saturation is found to be necessary for eliminating eddy current indications produced by variations in permeability in some non-magnetic tubing. The coil diameter did not appear to be a major factor as long as reasonable sizes were used. (C.E.S.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

Refer also to abstract 34082.

34116 (CONF-123-1) THE APPLICATION OF HYDROTHERMAL ZONING TO WYOMING URANIUM DEPOSITS. J. W. Gabelman and S. V. Krusiewski (Division of Raw Materials, AEC). May 1963. 50p.

From 8th Annual Uranium and Minerals Symposium, Riverton, Wyoming, June 1963.

Local and regional studies of hydrothermal districts in western Colorado and in the Andes Mountains of Peru, Chile, and Argentina have led to certain conclusions regarding the spatial and quantitative relations of uranium to other metals and have resulted in concepts of distribution of nonmetallic alteration minerals, uranium, and other metals. Mineralization intensity gradients correspond to temperature gradients ranging from the high temperatures of the initial solutions nearest their source at district centers to the low temperatures of these solutions in marginal environments. Changes in the temperature and composition of the solutions have resulted in a zonal arrangement of metals and alteration features between the large altered areas in mineral district centers and the marginal deposits of various types. In districts where other metals are prevalent uranium is most abundant in low-temperature marginal deposits. Districts in which uranium is the dominant metal are regionally marginal to other metal districts or belts of such districts. In uranium districts uranium deposits occur within large altered areas. Wyoming mineral deposits reveal the same zonal patterns noted elsewhere, suggesting that the theory may be on a correct track although the results are still inconclusive. (N.W.R.)

34117 (NP-12328(Rev.)) AARDVARK. Long Range Seismic Measurements [of] VELA UNIFORM Project 8.4. DATDC Report No. 67. (United Electrodynamics, Inc., Alexandria, Va.). July 3, 1963. Contract AF33(657)-7427. 29p.

The event and the recording station array are described, and an analysis of long range seismic data on the event and the subsequent collapse is given. Measurements at each station are listed, and seismograms for the collapse are included. The results (amplitudes, travel-times, magnitudes, etc.) are plotted. (D.C.W.)

34118 (PNE-112F(Pt.I)) SHOCK INDUCED TRANSITIONS. PART I. SAMPLE HISTORY AND SAMPLE RECOVERY. M. W. Nathans and A. Holzer (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 1, 1963. Contract [W-7405-eng-48]. Project GNOME. 52p.

The objectives and background of the shock-induced reactions program are discussed. A brief description is given of the samples, their methods of containment, and details of their emplacement in the Gnome environment, as well as details of their recovery. (auth)

34119 SOME FEATURES OF THE FORMATION OF EPIGENETIC URANIUM ORES IN SANDSTONES ON THE BASIS OF EXPERIMENTAL AND RADIOCHEMICAL DATA. L. S. Evseeva, K. E. Ivanov, and V. I. Kochetkov. At. Energ. (USSR), 14: 474-81(May 1963). (In Russian)

In view of the increasing importance of sedimentary epigenetic U deposits in the overall U reserves, the process involved in their formation gained considerable interest; in this respect, the argilleous and sandy minerals containing oval and crescent-shaped ores are of special importance. For the study of these processes, experiments were carried out, imitating the precipitation of U from aqueous solutions in sandstone layers, containing freshly deposited Fe sulfides. In this model, U-enriched oxidation and cementation zones were obtained; these zones were similar to the natural ones. It was established that the formation of U ores involves the continuous movement of the oxidation zone in the direction of the flow of the solutions, accompanied by the redistribution of U near the boundary of the oxidized and unchanged rocks. The results were confirmed by an examination of the radioactive equilibrium between ionium and uranium under natural conditions. It was concluded that ore deposits are formed by the epigenetic accumulation of U contained in the ground water at the boundary between the oxidation and reduction zones. The age of the examined ore deposits was estimated at less than 500,000 years; during this time the boundary between the oxidized and unchanged zones was estimated to have moved less than 500 m. (TTT)

34120 γ-RADIATION SPECTRA OF RADIOACTIVE ORES IN THEIR NATURAL DEPOSITS OBTAINED BY MEANS OF PROPORTIONAL COUNTERS. B. M. Kolesov, Yu. P. Lyubavin, and A. K. Ovchinnikov. At. Energ. (USSR), 14: 496-9(May 1963). (In Russian)

In view of the relatively poor resolution of scintillation counters with respect to γ quanta with energies below the 100-kev level, the soft portion of the spectrum was investigated with high-resolution proportional counters. A single-channel spectrometer was used; its γ detector consisted of a 200-mm high and 34-mm diameter chamber filled with Xe under a pressure of 2 atm. A steel cylinder served as cathode with a W wire as the collector electrode. The system had a resolution of 12% for the 32-kev γ quanta. Ore samples of 80 kg were used for the measurements. The spectrum presented a continuous distribution with a weak maximum between 25 to 30 kev. The continuous spectrum is due to the multiple scattering of the γ quanta within the ore deposit. Scintillation counters indicated a maximum in the 80 to 100 kev range; the difference is due to the different spectral characteristics of the counters. The proportional counter was found to be more sensitive with respect to changes in the $Z_{effect.}$ than the scintillation counter and is therefore suitable for use in γ logging and drilling under field conditions. It was found that the γ spectra of Th and U ores with identical $Z_{effect.}$ are not markedly different in the range below 100 kev. (TTT)

34121 VANURALITE, NEW URANIUM MINERAL. Georges Branche, Pierre Bariand, Francis Chantret, Robert Pouget, and Alexandre Rimsky (CEA, Paris and Faculte des Sciences, Paris). Compt. Rend., 256: 5374-6(June 17, 1963). (In French)

The optical and crystallographic characteristics, chemical composition, and formula of a new uranium mineral, given the name "vanuralite," are presented. It is a hydrated vanadate of uranium and aluminum with the formula $(UO_2)_2AlOH(VO_4)_2 \cdot 8H_2O$. It was found at Mounana (Gabon). (tr-auth)

34122 THE APPLICATION OF SPECTRAL ISOTOPIC ANALYSIS TO THE STRONTIUM METHOD OF DETERMINING GEOLOGICAL AGE. I. E. Starik and V. M. Aleksandruk. Dokl. Akad. Nauk SSSR, 150: 904-6(June 1, 1963). (In Russian)

In determining the absolute age of minerals by the Sr-

Rb method, the rubidium content was determined by flame photometry of the 7948 Å line, and the relative content of Sr^{87} was determined from the intensity of the fine-structure components of the Sr(II) 4077.8 Å line. The spectrograph was calibrated by using a series of standard samples containing from 7 to 95% Sr^{87}. The best reproducibility was obtained by using a discharge current of 4 to 7 ma at the hollow nickel cathode and a neon pressure of 1.2 to 1.5 mm Hg std. Isotopic dilution was used in order to determine the Sr^{87} content quantitatively. It was found that the age determinations by the spectral isotopic method were in good agreement with the results obtained by mass-spectroscopic measurements for minerals of lepidolite, muscovite, and biotite. The analysis time is significantly shorter with the spectral method than with the mass-spectroscopic method. (TTT)

34123 RESULTS OF TESTING NEUTRON–NEUTRON LOGGING IN THE COAL DEPOSITS OF DONBASS. O. D. Belomar, V. Y. Zaichenko, N. N. Kirichenko, and A. B. Chuyun (Inst. of Natural Resources, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. RSR, No. 5, 602-6(1963). (In Ukrainian)

Coal seams were investigated using neutron-neutron logging. All coal seams showed distinct maxima on the 3-cm probe and minima on the 30- and 45-cm probes. Neutron-neutron logging proved to be a highly efficient method for the identification of complex coal seams. (P.C.H.)

34124 STRATOSPHERIC TRITIUM. H. V. Buttlar (Technische Hochschule, Darmstadt, Ger.). Geochim. Cosmochim. Acta, 27: 741-51(July 1963). (In German)

Tritium measurements were performed on Darmstadt rainwaters and on monthly average rain water samples from a number of European and Asiatic stations. The north-south and east-west dependences of the tritium concentration are discussed on the basis of existing models for the atmosphere. The rate of influx of natural tritium into the troposphere was calculated from the east-west dependence to be 0.4 atoms T/cm^2 sec with an error of about 40%. The deposition of stratospheric tritium during the year of 1960 is in agreement with expectation. The tritium concentrations increased after the Russian weapon tests in the fall of 1961. (auth)

34125 CAESIUM IN SOME ALKALI GRANITES (YOUNGER GRANITES) OF NORTHERN NIGERIA. J. R. Butler and A. J. Thompson (Imperial Coll. of Science and Tech., London). Geochim. Cosmochim. Acta, 27: 769-73 (July 1963). (In English)

Cesium values for rocks from the composite intrusions at Liruei, Amo, Sha Kaleri, and Jarawa are tabulated together with K/Rb ration, which have been shown to be a guide to the stage of evolution of rocks in the individual complexes. The relation between Cs (which varies from 0.6 to 9.6 ppm) and K/Rb (which ranges from 25 to 270) was found to be quite haphazard within any complex. If all results are considered together, Cs is usually seen to be low in the earlier-formed rock types (with relatively high K/Rb ration), although some highly fractionated rocks contain just as little Cs while others show quite high values. The independent and erratic behavior of Cs in the Nigerian granites resembles that in some granites from Yugoslavia and New England. (P.C.H.)

34126 LOGNORMALITY OF THORIUM CONCENTRATIONS IN THE CONWAY GRANITE. John J. W. Rogers and John A. S. Adams (Rice Univ., Houston, Tex.). Geochim. Cosmochim. Acta, 27: 775-83(July 1963). (In English)

The frequency distribution of thorium concentrations in the Conway granite of New Hampshire was investigated by measurements with a portable gamma-ray spectrometer. A total of 737 determinations was made, including out-crops within the main central batholith, a set of blocks at one quarry, two 600-ft cores from the central mass, and one 500-ft core from a separate body of granite. A lognormal curve appears to be the best description of the frequency distribution of the sets of data. The lognormality fits the mathematical model used by the writers, which predicts a lognormal distribution of trace element concentrations from homogeneous samples of igneous rocks. The model also predicts an arithmetically normal distribution for most common elements and a distribution skewed opposite to lognormality for elements that constitute more than half of the sample studied. The lognormal distribution of thorium concentrations in the Conway granite correlates well with the primary nature of the thorium mineralizations. (auth)

34127 ON THE AGE DETERMINATION OF FERROMANGANIC NODULES OF THE INDIAN AND PACIFIC OCEANS. D. S. Nikolaev and E. I. Efimova. Geokhimiya, No. 7, 678-88(July 1963). (In Russian)

The results of a radiochemical investigation of ferromanganic nodules from the Pacific and Indian Oceans are outlined. The migration of Ra from internal layers was established. A strongly surplus Ra and Th^{230} content in the external and greatest part of internal layers was ascertained. The necessity of a differentiation of two concepts is noted: the absolute age of ferromanganic nodules and the time of their growth. The impossibility of establishing the absolute age of the nodules studied according to Ra and Th^{230} is shown. (auth)

34128 DETERMINATION OF MONAZITE ABSOLUTE AGE BY THE XENON METHOD. Yu. A. Shukolyukov and S. L. Mirkina (All-Union Research Inst. of Geology, Leningrad). Geokhimiya, No. 7, 699-701(July 1963). (In Russian)

An absolute age of North Karelia pegmatites determined by the uranium–xenon method was estimated to be $(1960 \pm 150) \times 10^6$ years, in good agreement with published data derived by the lead method. (R.V.J.)

34129 DETECTION OF RADIUM SCATTERING HALATION BY MEANS OF γ SPECTRA. N. D. Baiyasnyi, V. N. Vasilenko, R. M. Kogan, and Sh. D. Fridman. Izv. Akad. Nauk SSSR, Ser. Geofiz., No. 4, 596-605(Apr. 1963). (In Russian)

The feasibility of using γ spectra for determining the content of Ra by halation and scattering fluxes was analyzed. Correlations were made of effective detection with an interfering background. Results from γ-ray prospecting for radium, thorium and potassium are analyzed. (R.V.J.)

34130 EFFECTS OF GROUND MICRO-CONTOUR ON γ-RAY PROPAGATION IN NEAR-GROUND ATMOSPHERE. Yu. A. Izrael. Izv. Akad. Nauk SSSR, Ser. Geofiz., No. 5, 818-24(May 1963). (In Russian)

Topography effects the distribution of γ emission in the surface atmosphere. A $\beta_{0.5}$ angle of roughness creates a screening area for microprojections in the soil. In flat regions the $\beta_{0.5}$ magnitude is about 1°, in plowed fields, 4 to 5°, and in very rough fields it is ~9°. It is shown that the topography effects on γ propagation at small heights above plane source are considerable, but are very negligible for volume sources. (tr-auth)

34131 GAMMA-RADIATION ATTENUATION FOR MEASURING BULK DENSITY AND TRANSIENT WATER FLOW IN POROUS MATERIALS. J. M. Davidson, J. W.

Biggar, and D. R. Nielsen (Univ. of California, Davis). J. Geophys. Res., 68: 4777-83(Aug. 15, 1963).

A laboratory method, based on γ-radiation attenuation, is described for studying transient water flow in packed soil columns. The γ rays from a 200-mc source of Cs^{137} are collimated through a narrow slit, and the beam is then focused on a soil column. A radiation analyzer in the circuit allows only primary rays of energy 0.66 ± 0.15 Mev to be recorded. Both bulk density (g/cm^3) and water content of the soil (g/cm^3) can be calculated using an absorption equation. The method makes possible rapid and frequent measurement of the water content of soil as a function of time and position without disturbing the soil-water system. Experimental results for water moving into a uniformly packed air-dry soil are presented. (auth)

34132 FOSSIL TRACKS OF CHARGED PARTICLES IN MICA AND THE AGE OF MINERALS. P. B. Price and R. M. Walker (General Electric Research Lab., Schenectady, N. Y.). J. Geophys. Res., 68: 4847-62(Aug. 15, 1963).

After a summary of what has been learned about the registration and development of charged particle tracks from previous accelerator and reactor experiments, observations on natural background tracks are described. Tracks can occur randomly throughout a sample and in clusters, which are usually, but not always, associated with an identifiable structural feature such as an inclusion. Track densities vary from an unobservably low value to $>5 \times 10^4/cm^2$. The tracks appear most frequently in biotites and phlogopites, less often in muscovites, and still less often in lepidolites. Various possible origins of the background tracks are discussed, and it was concluded that spontaneous fission of uranium impurities is the most likely source. If the tracks arise in this way, track counts before and after reactor irradiation give, in principle, a measure of the age of the mica specimens. Ages determined in this way for two specimens were in approximate agreement with geologic ages, thus giving strong experimental confirmation of the spontaneous fission origin of the tracks. The results also indicate that the time constant for track fading must be $>10^8$ years. The possible use of the new technique as an accurate method of dating mica samples is discussed. Track densities also give a measure of U concentrations, and values ranging from approximately 10^{-8} to 10^{-11} atom fraction, exclusive of U in inclusions and grain boundaries, which shows that the solubility of U in mica is very small were found. Calculations also indicate that cosmic-ray-induced tracks should be found in certain specimens that have very low U concentrations and that have been at a depth less than that equivalent to 1 km of H_2O for long periods of time. The picture developed for mica applies equally well to other systems. (P.C.H.)

34133 RETENTION OF RADIOGENIC ARGON IN GLAUCONITES FROM PROTEROZOIC SEDIMENTS, NORTHERN TERRITORY, AUSTRALIA. A. W. Webb (Bureau of Mineral Resources, Canberra, Australia), Ian McDougall, and J. A. Cooper. Nature, 199: 270-1 (July 20, 1963).

Three glauconite concentrates from Proterozoic sediments of the Carpentaria region of the Northern Territory, Australia, which were dated by the potassium–argon method, show that there is almost complete retention of radiogenic argon. The results show that under certain conditions it is possible to obtain reliable ages on Proterozoic glauconites. It is suggested that the tectonic history of the region may have an important bearing on the degree of argon retention. (H.M.G.)

34134 FRACTIONATION OF SULFUR AND CARBON ISOTOPES IN A MEROMICTIC LAKE. Edward S. Deevey, Jr., Noboyuki Nakai, and Minze Stuiver (Yale Univ., New Haven). Science, 139: 407-8(Feb. 1, 1963). (TID-18014)

In the permanently stagnant depths of Green Lake, sulfide made by bacteria is depleted in heavy sulfur (S^{34}), and sulfate is enriched. The fractionation factor, 1.0575, is the greatest yet observed. Isotopic resemblance to salt-dome sulfur deposits is evident, and, like salt-dome calcite, the lake's CO_2 is depleted in heavy carbon (C^{13}). (auth)

34135 RADIOCARBON DATING: FICTITIOUS RESULTS WITH MOLLUSK SHELLS. M. L. Keith and G. M. Anderson (Pennsylvania State Univ., University Park). Science, 141: 634-7(Aug. 16, 1963). (In English)

Evidence is presented to show that modern mollusk shells from rivers can have anomalous radiocarbon ages, owing mainly to incorporation of inactive (C^{14}-deficient) C from humus, probably through the food web, as well as by the pathway of CO_2 from humus decay. The resultant effect, in addition to the variable contributions of atmospheric CO_2, fermentative CO_2 from bottom muds, and, locally, of carbonate C from dissolving limestones, makes the initial C^{14} activity of ancient fresh-water shell indeterminate, but within limits. Consequent errors of shell radiocarbon dates may be as large as several thousand years for river shells. (auth)

34136 RADIOCARBON ACTIVITY OF SHELLS FROM LIVING CLAMS AND SNAILS. Meyer Rubin and Dwight W. Taylor (Geological Survey, Washington, D. C.). Science, 141: 637(Aug. 16, 1963).

Measurements were made of the natural C^{14} activity of shells from living clams and snails collected from a variety of environments. Three samples were measured, representing growth in lime-poor, fairly soft, and lime-rich waters. The tracer study indicated that a snail can incorporate 10 to 12% inorganic C in making its shell and the remainder of the C in the shell carbonate must come from food or the atmosphere, and the resulting C^{14}/C^{12} ratio will be essentially the same as in those sources. The control laboratory snails ate modern food (lettuce), whereas the natural snails ate food with a C^{14}/C^{12} ratio similar to their environment and so showed the greater deficiency in C^{14}. The limiting value of a system in contact with the atmosphere is 50% dead C, theoretically possible, but not yet measured anywhere. Even such a great deficiency in C^{14} as this produces a constant error in the dating of unknown nonmarine carbonate samples of one C^{14} half life (5568 or 5730 years). Of greater significance is the post-depositional alteration and replacement of the original shell composition, which can add or subtract material. Neither visual nor mineralogic criteria can be used to predict the degree of this alteration. This can be determined only by mass spectrometric isotopic studies. (auth)

34137 RADIOISOTOPE DISTRIBUTIONS IN BASIC COMPONENTS OF FRESH WATER BASINS. E. A. Temofeeva-Resovskaya. Tr. Inst. Biol., Akad. Nauk SSSR, Ural'sk. Filial, No. 30, 1-77(1963). (In Russian)

A review is given on studies of radioisotope distribution in fresh water basins, considering accumulation by various organisms and components of the basin. Effects of complexing on the accumulation coefficient, experiments with periphyton radiostimulation, and dynamics of periphyton biomass accumulations are discussed. Water deactivation in slow-running basins and experiments with lake water and soil filters are also discussed. 187 references. (R.V.J.)

34138 RELATION BETWEEN DUAL ACIDITY AND STRUCTURE OF H-MONTMORILLONITE. Alfred M. Pommer (Geological Survey, Washington, D. C.). Geological Survey Professional Paper 386-C. 1963. 25p. (TEI-812). (GPO)

Potentiometric studies with hydrogen-sensitive and cation-sensitive glass electrodes supplemented by chemical determinations and x-ray diffractions on a hydrogen-montmorillonite prepared from API Reference Clay No. 23 (Chambers, Ariz.) indicated that the clay behaves as a mixture of two acids, resulting from the presence of two types of exchange sites, interlayer and edge, both occupied by hydrogen ions. The interlayer sites, which hold the hydrogen ions less tightly, cause the stronger acid function, and the edge sites, which form stronger hydrogen bonds, are responsible for the weaker acid function. Correlation of these data with information from the literature indicated that in the case of beidellites the pattern is reversed and the interlayer positions represent the weaker acid function. Application of Eisenman's theory of atomic selectivity to the clay led to the prediction that the stronger acid sites are more likely to hold cesium preferentially. This has bearing upon the problem of waste disposal of radioactive Cs^{137}. (auth)

34139 USE OF RADIOACTIVE SOURCES IN MEASURING CHARACTERISTICS OF SNOWPACKS. Henry W. Anderson, Philip M. McDonald, and Lloyd W. Gay (Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.). 9p. (CONF-11-4)

From American Nuclear Society Meeting, Washington, D. C., Nov. 1962.

Commercially available gamma and neutron probes were tested for their ability to measure snow density, ice lenses, and the thermal quality of individual layers in the snowpack. Preliminary test results also indicate that it may be possible to predict the start and rate of snowmelt from such measurements. (auth)

34140 WASHOUT OF TRITIATED WATER VAPOR BY RAIN. A. C. Chamberlain and A. E. J. Eggleton (Atomic Energy Research Establishment, Harwell, Berks, Eng.). 32p. (CONF-67-21; AERE-R-3970)

From Health Physics Society 8th Annual Meeting, New York, June 1963.

The rate of exchange of HTO vapor with raindrops is calculated on the assumption that the rate determining factor is diffusion across the boundary layer of air surrounding the drop. The specific activity of rain that has passed through a plume of HTO vapor from a stack is then calculated. When the specific activity of the rain on reaching the ground is plotted against distance from the foot of the stack, the curve has a peak at a distance equal to about one stack height but depending on wind speed. At distances greater than about 6 stack heights, the specific activity of the rain on reaching the ground is less than the specific activity of the water vapor in the air at ground level, due to downward diffusion of the plume of HTO. In most practical situations the permissible output of HTO from a stack will be determined by uptake of HTO vapor by persons downwind, and not by the washout in rain. (auth)

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Refer also to abstracts 33433, 33447, 33535, 33757, 35135, and 35136.

34141 (AERE-R-3719) PROGRESS IN BERYLLIUM MONITORING AT A.E.R.E. HARWELL. R. O. R. Brooks (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Sept. 1961. 11p.

Equipment is described that was designed or modified for use in environmental monitoring in beryllium laboratories. (C.H.)

34142 (BNL-7022) METEOROLOGICAL TOOLS FOR AIR POLLUTION CONTROL. Maynard E. Smith (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract [AT(30-2)-Gen-16]. 18p. (CONF-119-1)

From Air Pollution Control Ass'n. Meeting, Detroit, June 1963.

Meteorological facilities, techniques, and capabilities pertinent to air pollution control problems are discussed. An attempt is made to define the various meteorological tools of importance in this field, and to indicate something of their nature, quality, and status of development. Considerable detail is included regarding existing meteorological records, both public and private, as well as general specifications of instruments and data handling techniques. The most important tool, professional capability, is examined both from the point of view of current ability to solve air pollution problems and in terms of future needs as well. (P.C.H.)

34143 (CONF-39-35) GROUND ROUGHNESS EFFECTS ON THE ENERGY AND ANGULAR DISTRIBUTION OF GAMMA RADIATION FROM FALLOUT. Q. G. Klingler (Edgerton, Germeshausen and Grier, Inc., Boston; Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.; and Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.). [1962]. Contract AT(29-1)-1183. 22p.

From American Nuclear Society, Annual Meeting, Salt Lake City, Utah, June 1963.

Measurements were made of gamma radiation over fallout fields in Nevada. The terrain types used were flat dry lake beds, rough desert terrain, and plowed areas, and the measuring equipment was mounted on a truck along with a personnel shelter. Spectrometer measurements of angular and energy distribution and ion chamber measurements of dose vs. height were made. Dose angular distributions were obtained from the spectra and used to study the effect of ground roughness. (D.L.C.)

34144 (CONF-66-5) PROBLEMS OF ESTIMATING THE HAZARD OF RADIOIODINE FOLLOWING A NUCLEAR ATTACK. H. Hollister (Division of Biology and Medicine, AEC). [1963]. 25p.

From Symposium on the Biology of Radioiodine, Richland, Wash., June 1963.

A nuclear attack very clearly suggests unique factors to be considered in estimating the associated hazard to man from fallout radioiodine. These factors include possible heavy contamination from local fallout associated with surface bursts near population and agricultural centers; the general lack of information on the properties of fallout from land surface bursts over a range of continental soil types; the death of dairy cattle owing to the direct effects of the weapons, including external residual γ radiation; and uncertainties about what countermeasures would be operationally feasible under post-attack circumstances and what their effect would be. A hypothetical nuclear attack situation is postulated, and how information on the deposition and uptake of radioiodine would be used to arrive at an estimate of the exposure dose to man is considered. Doses of thousands of rads to the human thyroid are predictable, using available information and assuming no countermeasures. The question is thereby raised as to whether such estimates are valid, what their uncertainty might be, and what can be done to develop a better basis for estimation. At doses such as are estimated here, there is the further problem of effects to the human being, his thyroid, and his hematopoetic system. Effects on grazing animals, especially livestock, are also considered at radioiodine dose levels in the sublethal range. The fact is stressed that organized, interpretable information is needed at dose levels quite in contrast to those of usual concern for weapons testing or reactor accidents. (auth)

34145 (CONF-66-6) RADIOIODINE CONCENTRATION IN FETAL HUMAN THYROID GLAND FROM FALL-OUT. William H. Beierwaltes, Martin T. J. Hilger, and Audrey Wegst (Michigan. Univ., Ann Arbor). [1962]. Contract AT(11-1)-1203. 8p.

From Symposium on the Biology of Radioiodine, Richland, Wash., June 1963.

Measurements were made of the I^{131} content of thyroid glands from adults, children, fetuses, and hogs collected in Michigan between 1959 and 1963. The concentration of I^{131} in human fetal tissue remained fairly constant at background during the period and never reached maximum permissible concentration levels. It was concluded that values for I^{131} concentration in hog thyroids may be used as an index of I^{131} concentration in human thyroid tissue during periods of nuclear testing. (C.H.)

34146 (CONF-67-18) NEUTRON DOSIMETRY PROBLEMS IN A PLUTONIUM PROCESSING PLANT. J. R. Mann and M. R. Boss (Dow Chemical Co. Rocky Flats Div., Denver). [1962]. Contract AT(29-1)-1106. 13p.

From Health Physics Society Meeting, New York, June 1963.

Results show that a direct neutron dose measuring instrument, such as the Los Alamos 10-inch sphere, is satisfactory for measuring in the 0.1 to 1 Mev energy range. It is also possible to use a flux-measuring instrument to evaluate dose once the energy response of the instrument and average energy of the neutrons are known. Type A film can be used as a personnel neutron dosimeter provided calibrations are made with neutron sources having average energies the same as those being measured. Larger field areas must be read for lower energy neutrons to minimize the statistical errors and to reduce the minimum detectable dose. (N.W.R.)

34147 (CONF-67-20) ACCUMULATION OF FALLOUT RADIONUCLIDES IN COLORADO MULE DEER. Floyd W. Whicker and Adrian H. Dahl (Colorado State Univ., Fort Collins). [1963]. Contract AT(11-1)-1156. 10p.

From Health Physics Society 8th Annual Meeting, New York, June 1963.

A study of the accumulation of fallout radionuclides in Colorado mule deer, supported by forage and environmental monitoring, was initiated in October 1961. Data are pre-

sented on levels of I^{131} in thyroids of animals sacrificed at weekly intervals since this date. Studies on differences of I^{131} accumulation between sexes and different age groups were also carried out by obtaining deer thyroids from successful hunters during Colorado big game seasons. Measurements were made on whole thyroids by use of a well-type scintillation detector. The thyroids have shown marked responses to nuclear tests and concentrations have ranged from less than 0.01 to 60 nC/g of tissue. In 1962, the average thyroid burden was about 5 nC/g, which would roughly correspond to a thyroid dose of 18 rad for the year. Observations have indicated that fetuses may have thyroid concentrations of I^{131} ten times that of the pregnant female. The thyroid I^{131} concentration of the fetus with respect to the dam appears to increase exponentially with fetal age. Relations between sex, age, or stable I content of the thyroid and thyroid I^{131} burden were not apparent. (auth)

34148 (CONF-67-26) EVALUATING THE PERFORMANCE OF SUPPLIED AIR RESPIRATORS. Bruce J. Held (Idaho Operations Office. Health and Safety Div., AEC). [nd]. 16p.

From Health Physics Society 8th Annual Meeting, New York, June 1963.

Supplied air respirators are the types of respiratory devices that provide man with sufficient oxygen in a mixture of other nonharmful gases to live and work in an otherwise toxic breathing environment without loss of strength or facilities. This type of equipment may be a self-contained apparatus or installed in a fixed air supply. Three types of self-contained, portable apparatus are evaluated as to safety, wearer acceptance, cost, serviceable time, cold-weather operation, ease of decontamination, and other less important factors. The supplied air respirators used at NRTS are described. (C.H.)

34149 (CONF-84-2) INDUSTRIAL HYGIENE ASPECTS OF UNDERGROUND NUCLEAR WEAPON TEST DEBRIS RECOVERY. Floyd W. Wilcox (Reynolds Electrical and Engineering Co., Inc. Health and Safety Div., Mercury, Nev.). Mar. 27, 1963. Contract AT(29-2)-162. 8p.

From American Industrial Hygiene Conference, Cincinnati, May 1963.

The formation of a collapse crater by underground nuclear explosions is described. Safety problems associated with the re-entry of underground nuclear explosion areas include cavity collapse, toxic gases, explosive gases, radioactive gases, radioactive core, and hazards from the movement of heavy equipment on unstable ground. Data from television, geophones, and telemetered radiation detectors determine when radiation and toxic material surveys of the area can be made and drills can be used to obtain samples of the bubble crust for analysis. Hazards to personnel engaged in obtaining weapon debris samples are reviewed. Data are presented on the radiation dose received by personnel at the Nevada Test Site engaged in this work during 1962. (C.H.)

34150 (CRRD-1110) THE INFLUENCE OF PACKAGING ON RADIATION FIELDS FROM RADIOACTIVE SHIPMENTS. George Cowper (Atomic Energy of Canada Ltd., Chalk River, Ont.). June 21, 1963. 12p. (AECL-1802)

Errors involved in the determination of contact dose rates are discussed and proposals are made which will permit a better assessment of radiation situations encountered in practice. (auth)

34151 (LADC-5515) IODINE SAMPLING WITH SILVER NITRATE-IMPREGNATED FILTER PAPER. H. J. Ettinger (Los Alamos Scientific Lab., N. Mex.). [1962]. Contract [W-7405-eng-36]. 25p. (CONF-66-2)

From Symposium on the Biology of Radioiodine, Richland, Wash., June 1963.

The use of silver nitrate-impregnated radioiodine filters was evaluated under laboratory and field conditions. Preliminary laboratory tests indicated radioiodine filter efficiencies of 91-96%. When sampling a stack effluent containing a variety of reactor waste products, radioiodine filter efficiencies of less than 8% were obtained. Sampling effluent gases from hot cells where reactor fuel elements are handled resulted in a median radioiodine filter efficiency of 20% with efficiencies as high as 96-100% under certain operating conditions. Test results show that silver nitrate-impregnated radioiodine filters do not provide a reliable method for monitoring the release of iodine to the atmosphere. (auth)

34152 (SC-4774(RR)) FALLOUT REPORT: BETA-GAMMA RADIOACTIVITY IN AIR AT SANDIA LABORATORY JULY THROUGH DECEMBER 1962. R. E. Womelsduff (Sandia Corp., Albuquerque, N. Mex.). July 1963. Contract AT(29-1)-789. 13p.

Data on the gross beta-gamma radioactivity (expressed as $\mu\mu C/m^3$) of air samples collected at the Sandia Laboratory during the second half of 1962 are reported. (auth)

34153 (SC-4926(RR)) FALLOUT REPORT: BETA-GAMMA RADIOACTIVITY IN AIR AT SANDIA LABORATORY, JANUARY-JUNE 1963. R. E. Womelsduff (Sandia Corp., Albuquerque, N. Mex.). July 1963. Contract [AT (29-1)-789]. 11p.

Data are presented on gross beta-gamma radioactivity of air samples collected at Sandia Laboratory during the first half of 1963. (C.H.)

34154 (SCPRI(RM)VI-1963) RAPPORT D'ACTIVITE, JUIN 1963. (Report of Activities, June 1963). (France. Service Central de Protection contre les Rayonnements Ionisants, Paris). 15p.

The results of the radiological monitoring of the atmosphere, rain water, nuclear sites, the food chain, and sea water are briefly summarized and shown graphically and in tabular form. (J.S.R.)

34155 (TID-3552(Rev.2)) SHIPPING AND STORAGE OF RADIOACTIVE MATERIALS. A Literature Search. Theodore F. Davis, comp. (Division of Technical Information Extension, AEC). May 1963. 32p.

A total of 276 references are included to report and published literature on shipping and storage of radioactive materials. An additional 32 references to engineering drawings are included. The search contains personal author and report-number indexes. (auth)

34156 (TID-18892) OFF-SITE ENVIRONMENTAL CONTAMINATION FROM NUCLEAR EXPLOSIVES AT THE NEVADA TEST SITE, SEPTEMBER 15, 1961-SEPTEMBER 15, 1962. (Division of Operational Safety, AEC). 65p.

Data are presented on the physical characteristics, relative amounts of various isotopes released, and degree of environmental contamination resulting from the detonation of 52 nuclear devices at the Nevada Test Site between Sept. 15, 1961 and Sept. 15, 1962. The off-site monitoring program is described. Data are presented on exposures received by off-site individuals as recorded on film badges, and levels of radioactivity in samples of milk, air, and water collected at various locations. (C.H.)

34157 CLINICAL USE OF TELEVISION IN RADIOLOGY. Kurt-Heinz Wuttge (Universität, Munich). Aerztl. Forsch., 16: 219-25 (May 10, 1962). (In German)

Various types of technique and apparatus employing television with portable image-amplifier x-ray devices for use

in fluoroscopy and radiology are described, and their advantages, especially in reducing the radiation dose to the patient and operators, are discussed. By use of the described procedures, combined with the wearing of a lead apron, it was possible to reduce the operator's gonadal dose from 2 mr to 0.08 mr during a 1-min fluoroscopic examination. (H.H.D.)

34158 ADVANCES IN RADIATION PROTECTION. Rudolf Wittenzellner (Gesellschaft für Kernforschung, Karlsruhe, Ger.). Aerztl. Forsch., 16: 244-7(May 10, 1962). (In German)

A discussion is presented of the organization and the projects planned for the Versuchs- und Ausbildungsstätte für Strahlenschutz, a subsidiary department of the Gesellschaft für Kernforschung. This laboratory will be concerned with research on medical and biological problems of radiation protection. A discussion is also provided of the author's observations of atomic bomb sequelae during a tour of Japan in 1958. (H.H.D.)

34159 THE RADIATION EXPOSURE OF PATIENTS IN X-RAY DIAGNOSTIC EXAMINATIONS. Marie-Luise Arnal and Herbert Pychlau. Aerztl. Forsch., 16: 247-58(May 10, 1962). (In German)

Techniques and results of measurement of doses received by persons undergoing various radiographic procedures are presented. The definition of the incident surface dose is given and its relation to gonad and bone marrow doses is discussed. The doses in patients were measured on the basis of the value $r \cdot cm^2$ with the Dosimeter Diamentor (manufactured by Physikalisch-Technische Werkstätten Dr. Pychlau K. G.), which employed an ionization chamber placed behind the subject being x rayed. The $r \cdot cm^2$ values for examination of various body regions were: thorax 443, gall bladder 1235, esophagus 2670, small intestine 3305, stomach 6670, esophagus-stomach 8200, and colon 8400. The x-ray intensity varied from 50-kv for thoracic to 90 kv for colonic examination and the dose rate from 3.5 to 9.7 r/min, respectively. Various other criteria for evaluating patient doses are discussed. (H.H.D.)

34160 CURRENT PROBLEMS IN RADIOPROTECTION RESEARCH. PROJECTS AND PLANS OF THE INSTITUT FÜR STRAHLENSCHUTZFORSCHUNG. Otto Hug (Institut für Strahlenschutzforschung, Nuremberg). Aerztl. Forsch., 16: 258-61(May 10, 1962). (In German)

34161 DECONTAMINATION OF Co-60 CAPSULES. Junichiro Furuta, Tamotsu Kanazawa, Shinichi Okamoto, and Yukio Tsujii. Ann. Rept. Radiation Center Osaka Prefect., 3: 90-1(1962). (In English)

The decontamination of Co^{60} gamma sources is reported. A supersonic cleaner with soapless-soap was found to be the most effective cleaning method for Co^{60} pencils. The surface was easily decontaminated to less than 10^{-4} $\mu C/cm^2$. (P.C.H.)

34162 RADIATION HYGIENE IN AND AROUND A NUCLEAR POWER STATION. J. H. Martin (United Kingdom Atomic Energy Authority, Annan, Scotland). Atom, No. 81, 219-28(July 1963).

The operation of Chapelcross is presented in relation to its experiences in radiation safety. From the Chapelcross study it is concluded that by proper training of staff and by intelligent use of control measures, a nuclear power station can be operated without personnel receiving unacceptable levels of radiation exposure. Further, the small quantities of radioactive effluent that arise from the operation of a nuclear power station and that are discharged into the environment have no detrimental effect on that environment or its population. (H.M.G.)

34163 STRONTIUM-90 IN HUMAN DIET IN NORTHERN AND SOUTHERN RHODESIA. W. R. Carr (Government Analyst's Lab., Salisbury, Southern Rhodesia) and E. R. Mercer. Central African J. Med., 8: 183-6(May 1962).

Sr^{90} content in grain crops has frequently exceeded that in other foods; particular attention was, therefore, given to maize, which is the main source of calories in the African's diet. The other foods selected for this survey are commonly eaten by Africans and are relatively good sources of Ca: the millet rapoko (Eleusine coracana), peanuts (Arachis hypogaea), and milk. The grain samples were taken shortly after the 1959 harvest and were therefore planted in late 1958 at the beginning of the rainy season and harvested in April–June, 1959. Milk was sampled in October, 1959, a hot, dry month immediately preceding the rains; January 1960, in the middle of the rainy season and at the time of high milk production; April 1960, at the end of the rainy season; and August 1960, a cool month in the middle of the dry season. The two Sahara nuclear test explosions took place on 13th of February, 1960, and 1st of April, 1960. The Sr^{90} and Sr^{90}/Ca values, respectively, per kg dry wt were as follows: maize <3 $\mu\mu c$, <38 $\mu\mu c/g$; peanuts 9.79, 17.7; rapoko 44.3, 10.3; milk 5.9–14.0, 0.56–1.34. It is estimated that the average monthly dietary intake of Sr^{90} of the urban African population is <57 $\mu\mu c$. Because of the low Sr^{90} content per kg of maize, more precise determinations were impossible; the figure quoted is the upper limit only. A comparison of the results for two samples of peanuts suggests that contamination was highest in the areas of high rainfall. Only a small variation with rainfall was observed with rapoko, which was by far the most important source of contamination. With milk, appreciably higher values were found in the Spring of both years (October 1959, and August 1960). The markedly lower ratios of Sr^{90} to Ca in milk than in vegetable foods reflect the discrimination which occurs against Sr relative to Ca in their passage from the diet of cattle to milk. Although the content of milk was under 10% of that observed in the United Kingdom in 1959, the estimated ratio of Sr^{90} to Ca in the diet for the population of the urban areas differs little. It was concluded that on average the content of diet was less than $\frac{1}{20}$ of the recommended max permissible level and that it did not reach $\frac{1}{10}$ for any large section of the African population. It appears that the contamination of the diet of Europeans in Rhodesia was considerably lower than that in the United Kingdom. (H.H.D.)

34164 ON THE PROBLEM AND DETECTION OF SO-CALLED "HOT" PARTICLES. J. Matoušek, F. Mertl, and S. Patočka (Karlova Univ., Pilsen, Czechoslovakia). Cesk. Hyg., 8: 241-6(1963). (In Czech)

The detection of so-called hot particles, i.e., particles with a high specific activity, by means of autoradiography of sticky plates and membrane ultrafilters is described. The problem of the investigation of these particles and their physical and biological properties are discussed. (auth)

34165 INVESTIGATIONS ON THE RADIOACTIVITY OF AIR AND PRECIPITATIONS. Hubert Garrigue (Observatoire du Sommet du Puy de Dôme, France). Compt. Rend., 257: 204-5(July 1, 1963). (In French)

The β radioactivity of the air and precipitations measured at the observatory on Puy de Dome is reported for March to June 1963. The results are tabulated. The radioactive contamination of the interior of residences

was also measured. The results show that the artificial radioactivity of the air and precipitations remains significant. (J.S.R.)

34166 MEASUREMENT OF RADIOACTIVITY IN FOODSTUFFS. PRELIMINARY REPORT OF RESULTS ON MILK OF KNOWN ORIGIN DURING THE PERIOD 4th SEPTEMBER TO 11th NOVEMBER 1961. P. Jaegerhuber, D. Stoll, and K. G. Bergner (Chem. Landesuntersuchungsanst., Stuttgart). Deut. Lebensm.-Rundschau, 57: 333-5 (1961).

Determinations of I^{131} and of the total β-activity of the precipitated carbonates (Sr^{90}, Sr^{89}, Ba^{140}, and Cs^{137}) were made. Increases in the carbonate β-activity were less marked than, but generally followed the same pattern as, those of I^{131}. (TCO)

34167 PROBLEMS OF PROTECTION IN THE FABRICATION OF URANIUM AND ITS COMPOUNDS. Emilio Iranzo Gonzalez. Energia Nucl. (Madrid), 7: No. 25, 42-59 (Jan.-Mar. 1963). (In Spanish)

The radiation dangers in the fabrication of U and its compounds are described in some detail. The radioisotopes present in the fabrication process, the problems they present, and the maximum permissible concentrations are discussed. The special controls required because of criticality and the pyrophoretic properties of uranium are decsribed. (J.S.R.)

34168 RADIOACTIVE POISONING OF FRUIT AND VEGETABLES. H. Seidler and M. Haertig. Ernaehrungsforschung, 6: 596-600(1961).

The radioactivity of a range of fruits and vegetables was investigated to determine the effects of fallout. Activity in the ash depends on whether the plant grows above or underground, the area and nature of the leaf surface, and the thickness of the epidermis. (Atomdokumentation, 4: No. 14, Nov. 1962)

34169 HUMAN FACTORS AND THE WORLD ENVIRONMENT. III. OPERATIONAL, EMOTIONAL, AND LEGAL PROBLEMS IN THE APPLICATION OF MAXIMUM PERMISSIBLE RADIATION DOSE. W. B. Harris and Hanson Blatz (New York City Office of Radiation Control). J. Occupational Med., 3: 294-9(June 1961).

Popular misconceptions and exaggerated fears of the public concerning the hazards of radioactivity are discussed and attempts are made to show the considerably greater hazards of other features of modern life, such as insecticides and the automobile, which arouse less public anxiety. Examples of news articles in the public press exaggerating radiation hazards are cited, and actual vs reported happenings are contrasted. It is suggested that, for many reasons, max permissible doses and concentrations have been very conservatively calculated. (TCO)

34170 MEDICAL SUPERVISION OF WORKERS WHO MAY BE EXPOSED TO RADIATION. George L. Voelz (Atomic Energy Commission, Idaho Falls, Idaho). J. Occupational Med., 4: 212-20(Apr. 1962).

A review of recommended practices for medical supervision of workers potentially exposed to radiation does not disclose significant differences from standard comprehensive industrial medical practice. The areas of special interest on pre-placement and periodic examinations are primarily an evaluation of previous radiation exposures and the diagnosis of certain conditions which may be confused with delayed radiation effects. Physical requirements of the job, apart from radiation considerations, often become more important in job placement and work limitations than the problems associated with radiation per se. The radiological health program must put major emphasis on establishing adequate means for measuring external and internal radiation doses. Careful monitoring of radiation levels in the plant is essential to keep exposures at minimal levels. In the final analysis, careful medical supervision remains the essential means of evaluation. (auth)

34171 HYGIENIC STANDARDIZATION IN DESIGNING, CONSTRUCTION AND OPERATION OF ELECTRIC ACCELERATORS. P. I. Moiseitsev. Med. Radiol., 8: No. 5, 54-8(May 1963). (In Russian)

Basic provisions, requirements, and standards of new sanitary regulations for siting and operation of electronic accelerators up to 100 Mev are discussed. (P.C.H.)

34172 ^{131}I, ^{137}Cs, ^{140}Ba, AND ^{140}La CONTENT OF GERMAN MILK IN THE PERIOD SEPTEMBER 1961 TO JANUARY 1962. E. Knoop and O. Paakkola. Milchwissenschaft, 17: 289-94(1962).

Milk samples were submitted fortnightly by 150 dairies throughout Germany. The highest I^{131} values were noted towards the end of October 1961 being 178 pc/l for the north, 148 pc/l for the center, and 108 pc/l for the south. In the same period, the maximum Ba and La content was 90 pc/l. Cs, estimated simultaneously, remained nearly constant. Milk attained a maximum I value 4 days after a very heavy rainfall while Ba maxima were observed 6 to 7 days later. (Atomdokumentation, 4: No. 14, Nov. 1962)

34173 CAESIUM-137 CONTENT OF LAMBS. A. H. Kirton (Michigan State Univ., East Lansing), A. M. Pearson, and E. C. Anderson. Nature, 199: 294(July 20, 1963).

The cesium-137 gamma activity of 10 lambs, which had been used previously to investigate some relations between potassium-40 content and composition, was measured on the Los Alamos human counter. An increase in the cesium/potassium ratio resulted from washing. Although large amounts of potassium were removed by the washing, little cesium was removed. Results indicate that the cesium/potassium ratio in the washed lambs and their components was fairly constant. Cesium levels in these lambs are compared to cesium levels in other animals in the United States and abroad. Possible relations between cesium levels and nuclear weapons tests are noted. (H.M.G.)

34174 SOCIAL EFFECTS OF NUCLEAR WAR. Robert A. Dentler and Phillips Cutright. Nucl. Inform., 5: 1-10(July 1963).

The effects of thermonuclear wars of varying levels on the population, economy, political organization and certain aspects of the physical environment of the United States were discussed. An attack of 1000 to 2000 megatons on urban targets would have a staggering impact on the major components of the American social system. From the post-World War II recovery experience of Germany and the Soviet Union it is concluded that no reasonable parallel can be drawn between the level of economic disorganization that followed World War II and the effects of a thermonuclear war on the American economy. Further, devastation of vital sectors of the labor force, yet unknown mass ecological effects of radiation, the unpredictable reaction of the surviving population to the holocaust, and the chance that a political order adequate to the challenge would not emerge force us to conclude that recovery of American society would be unlikely. The difficulty of recovery from relatively minor devastation was illustrated with the case of Hiroshima. As was found in the German case, recovery was dependent upon the amount of aid given by surrounding

population and American military forces, and the existence of a stable political order. Only if favorable conditions are present is there evidence that modern interdependent societies are capable of recovery from what would now be called a very limited attack. There is little reason to believe that such favorable conditions would exist in the United States following a thermonuclear war. (auth)

34175 A NEW DEVICE TO REDUCE PATIENT IRRADIATION AND IMPROVE DENTAL FILM QUALITY. Fred M. Medwedeff, William H. Knox, and Paul Latimer (Vanderbilt Univ., Nashville). Oral. Surg. Oral Med. Oral Pathol., 15: 1079-88(Sept. 1962).

The use of a simple device, to be held in the mouth, which collimates, shields, facilitates aiming, and holds the film during dental x ray is described. The device collimates the beam to dimensions only slightly larger than those required for exposure of the film. It also permits aiming of the machine by technical personnel, reduces irradiation of the patient to a small fraction of that involved in conventional techniques, and improves the quality of the roentgenograms by minimizing scattering from adjacent tissues. The device consists of a stainless steel circular collimator with a rectangular window. Attached to the collimator is an arm which holds the film in proper relation to the window. Reduction of exit rays is accomplished by a metal supporting shield behind the film in exposure of periapical and bitewing views in adults and children. Though applicable to both long- and short-cone techniques, the device can be used more simply with the long cone. The opening (1.62 $in.^2$) in the collimator passes 23% instead of the actual 19% of the 3-in. beam needed for the film. It was calculated that the combination used, a 0.0026-in. lead film backing and 0.051-in. stainless steel film support, transmits 3% at 65 kvp and 10% at 90 kvp. These values were checked by measuring transmission, using x-ray film as a radiation detector, and approximate agreement was obtained with these calculations. Considering all reductions of the beam by collimator, film backing, and shield, it was found that at 65 kvp 11% of the original beam passes beyond the film plane with this device and that the irradiation of the tissue between the cone and the plane of the film is reduced to 26% of that which would take place without the device. It is concluded that with this device the safety of dental roentgenology is improved many fold. (H.H.D.)

34176 THE EFFECTIVE USE OF X RAY RADIATION IN DENTISTRY. John H. Barr (Tufts Univ., Boston), Robert E. Silha, and Albert G. Richards. Oral Surg. Oral Med. Oral Pathol., 16: 294-304(Mar. 1963).

A report of the Radiation Protection Committee of the American Academy of Oral Roentgenology on recommendation for reducing exposure to patient and dentist during oral radiographic procedures is reviewed. The following aspects of the problem of exposure reduction are considered: max permissible exposures to operators and patients, sources of radiation in dental offices, recommended building materials to be used for wall construction (with their lead equivalents), and detailed statements of procedures for protecting operators and patients. (TCO)

34177 EXTRACORPOREAL IRRADIATION OF BLOOD: CALCULATIONS OF THE RADIATION DOSE. D. N. Slatkin, C. R. Jansen, E. P. Cronkite, and J. S. Robertson (Brookhaven National Lab., Upton, N. Y.). Radiation Res., 19: 409-18(July 1963). (BNL-6580)

Mathematical formulas were developed and are described which approximate the varying radiation dose delivered to various fractions of blood during continuous extracorporeal irradiation for any time after commencement of the procedure. The fraction of the blood which is irradiated n times in each of several total number of traversals was calculated with a digital computer, and a graph of the results with corresponding radiation doses is presented. This system is analogous to a liquid being pumped through a radiation field from a continuously mixing reservoir and back to the reservoir. (auth)

34178 FIRST-COLLISION DOSES PRODUCED BY FAST NEUTRON FLUXES OF WIDE ENERGY DISTRIBUTIONS. M. L. Randolph (Oak Ridge National Lab., Tenn.). Radiation Res., 19: 492-511(July 1963).

Analytic methods for evaluation of the ratios of first-collision dose to fast neutron flux for five classes of neutron spectra were developed. Results in terms of rads in tissue and bone have been calculated for examples of each distribution and in terms of rems for all but one distribution. Doses for several other hydrogenous materials may be obtained by multiplying tissue doses by stated factors. The neutron distributions describe fission spectra, evaporation spectra, multigroup spectra, and spectra resulting from cosmic rays. Vagaries in this method of dosimetry are discussed briefly. The ratio of dose in bone to that in tissue is found to be 0.44 in every case examined. A fast neutron dose rate of 10 to 20 millirems/day in the upper atmosphere is estimated. (auth)

34179 THE DEPENDENCE OF RBE ON THE ENERGY OF FAST NEUTRONS. III. EVALUATIONS OF RADIATION QUALITY. M. H. Biavati, W. Rosenzweig, H. H. Rossi, and I. Miyanaga (Columbia Univ., New York). Radiation Res., 19: 512-25(July 1963).

Measurements of the distribution of dose in Y (the energy delivered to tissue spheres divided by sphere diameter) were carried out at eight neutron energies between 0.34 and 1.8 Mev for a range of sphere sizes. Mean values of Y are compared with idealized values based on calculations of LET spectra. Implications of the results are discussed. (auth)

34180 THE LINEAR ENERGY TRANSFER DISTRIBUTIONS RESULTING FROM PRIMARY AND SCATTERED X-RAYS AND GAMMA RAYS WITH PRIMARY HVL'S FROM 1.25 mm Cu TO 11 mm Pb. W. R. Bruce, M. L. Pearson, and Helen S. Freedhoff (Ontario Cancer Inst., Toronto). Radiation Res., 19: 606-20(Aug. 1963).

The linear energy transfer (LET) distribution and the number and energy average LET of electrons set in motion by primary and water-scattered beams of radiation with primary half value layer from 1.25 mm Cu to 11 mm Pb are presented. The effect of energy degradation due to scatter in H_2O is very small. Few biological systems are likely to be sensitive enough to changes in LET to make the effect of energy degradation in an absorber biologically significant. (auth)

34181 STUDIES ON THE DECONTAMINATION AGENT FOR RADIOACTIVE SURFACE CONTAMINATION. Yasushi Nishiwaki and Hajime Nishioka. Radioisotopes (Tokyo), 12: 109-14(May 1963). (In Japanese)

34182 IODINE-131 IN UTAH DURING JULY AND AUGUST 1962. Robert C. Pendleton, Ray D. Lloyd, and Charles W. Mays (Univ. of Utah, Salt Lake City). Science, 141: 640-2(Aug. 16, 1963).

Nuclear explosions in Nevada in July 1962 caused an average intake of about 58,000 pC of I^{131} and a peak intake of 800,000 pC of I^{131} by Utah residents consuming one liter

of milk per day. Corresponding infant thyroid doses were about 1 rad (average) and 14 rad (peak). (auth)

34183 RADIATION HAZARD TO PATIENTS IN BRITAIN FROM RADIOLOGICAL PROCEDURES. F. W. Spiers (Univ. of Leeds, Eng.). Trans. N. Y. Acad. Sci., 25: 190-200(Dec. 1962).

Results of a survey are reported of radiation doses in general diagnostic radiology, mass miniature radiography (photofluorography) of the chest, dental radiography, radiotherapy of nonmalignant disease, and radiotherapy of malignant disease, including the uses of radioisotopes. A field survey included measurements in 130 hospitals and chest clinics selected to give a representative cross-section of radiological practice. Male gonad doses were measured directly by an ionization chamber placed in contact with the scrotum. Female doses were derived indirectly by measuring the scatter dose (or the primary dose if the chamber was in the beam) at a point on the anterior abdominal wall to the level of the iliac crest and relating this to the ovary dose by supplementary measurements made on a specially constructed model. In pelvis, lumbar spine, and lumbo-sacral joint examinations of adult males, measured gonad doses per examination ranged from less than 0.1 mr to more than 10,000 mr, with a mean dose of 387 mr. In examinations of the chest, heart, and lung, measured gonad doses ranged from 0.01 mr to 100 mr in adult males, and to 500 mr in adult females. The cause of high doses in this case was the use of needlessly large x-ray beams and on some occasions a complete absence of diaphragms or cones. In the 1131 chest, heart, and lung examinations measured, 10% of the exposures on males and 51% of those on females included direct gonad exposure. Almost ¼ of the 6000 radiographs of females used a beam area at least twice that of the film. To estimate bone-marrow doses in diagnostic radiology, depth-dose data were obtained by measurements at 12 marrow sites using a wax-impregnated skeleton as a model. It was evident that the examinations ranking high in marrow dose were not the same as those which contribute most to the gonad dose. A large part of the total dose is contributed by barium meal, mass miniature radiography, and chest examinations. Because active marrow is widely distributed throughout the skeleton, it seems unlikely that the results for any one type of examination will show variations as great as those for the gonad dose, where great differences can be caused by a small shift of the beam edge. It seems unlikely that improvements in technique can bring about a reduction in the marrow dose as dramatic as that suggested as practicable in the gonad dose, limitation of beam size being the most important reducing factor. (TCO)

34184 DAMAGE TO LIVESTOCK FROM RADIOACTIVE FALLOUT IN EVENT OF NUCLEAR WAR. Publication 1078. Washington, D. C., National Academy of Sciences—National Research Council, 1963. 98p. $2.00.

A review is presented on the hazards of fallout to livestock in event of nuclear war. The effects of external radiation on farm animals; effects from ingestion of fission products; internal exposure to gamma and beta rays; effects of contact with radioactive materials; animals and poultry as sources of food; exposure of marine life; sterility, sexual, genetic, and embryologic effects; and protective considerations for husbandmen are discussed. Data on biological availability of fallout in relation to its distribution, multiplying factors for permissible concentrations, added hazard to livestock from consumed fission products, and I^{131} dose to thyroids of adults and children from drinking milk following nuclear attack are appended. 227 references are included. (P.C.H.)

34185 NUCLEAR SAFETY. Volume 4, No. 4. William B. Cottrell, ed. (Oak Ridge National Lab., Tenn.). June 1963. (GPO) $0.55 (domestic), $0.70 (foreign). (One of the Technical Progress Reviews prepared quarterly for the Division of Technical Information, USAEC). 182p.

Significant developments in the field of nuclear safety relevant to the analysis and control of hazards associated with nuclear reactors, operations involving fissionable materials, and the products of nuclear fission are reviewed. Primary emphasis is on safety in reactor design, construction, and operation; however, safety considerations in reactor fuel fabrication, spent-fuel processing, nuclear waste disposal, and related operations are also treated. Fields having a direct bearing on nuclear safety are reviewed. A feature article on the reliability of reactor control systems is presented. (N.W.R.)

34186 PRIKLADNAYA DOZIMETRIYA. (Applied Dosimetry). K. K. Aglintsev, V. M. Kodyukov, A. F. Lyzlov, and Yu. V. Sivintsev. Moscow, Gosatomizdat, 1962. 248p.

Physical principles of dosimetry, methods and equipment for recording ionizing radiation, and practical applications of dosimetric measurements are discussed as well as protection methods in industry and laboratories. (R.V.J.)

34187 CODE OF PRACTICE AGAINST RADIATION HAZARDS. Fourth Edition. 1962. London, Imperial College of Science and Technology. 42p.

Regulations applicable to the use of equipment producing ionizing radiation, to accelerators, and to the use of sealed and unsealed radioisotopes are given. Mandatory portions of the code that deal mainly with administration and control are listed, and more detailed information and advice on practice are given. Emphasis is given to radiation health hazards and precautions for avoidance. (H.M.G.)

34188 WALK-THROUGH SHOE MONITOR, MODEL II (Engineering Materials). (Du Pont de Nemours (E. E.) & Co. Savannah River Lab., Aiken, S. C.). (CAPE-1006)

This package contains 7 drawings. The model II shoe monitor is an improved version of the walk-through shoe monitor. This later version has improved circuitry and has 32 G-M tubes mounted beneath a platform. The model I monitor employs 28 G-M tubes. Significant amounts of beta particles or gamma radiation detected by the G-M tubes are indicated by counting meters in a separate console that also provides visual and aural alarms if a predetermined alarm level is exceeded. The G-M tubes are connected in eight sets of four tubes each. There are 8 count rate meters. The out-put current of each count rate circuit operates a contact meter relay. The contacts in the meter relays, when closed on an alarm indication, actuate a second relay that energizes the a-c alarm circuits. A walk-through monitor for hands and shoes is included. (F.E.S.)

34189 A BASIC TOXICITY CLASSIFICATION OF RADIONUCLIDES PROPOSED BY THE INTERNATIONAL ATOMIC ENERGY AGENCY. H. T. Daw. 6p. (CONF-67-11)

From Health Physics Society Meeting, New York, June 1963.

Radionuclides were classified by the International Atomic Energy Agency according to the biological injury caused when incorporated in the human body. The term injury is meant to include implicitly the possibility of occurrence of late somatic effects. For a basic toxicity classification, the most important mode of entry was considered to be inhalation. Using mode of entry and other criteria, it was found that a factor of about 10^8 exists in relative toxicity

between radionuclides of highest and lowest toxicity. Data upon which the classification is based is applicable only to a standard man. (H.M.G.)

34190 NUCLEAR ENERGY, TORT LIABILITY, AND FINANCIAL PROTECTION. David F. Cavers (Harvard Univ., Boston). 20p. (CONF-98-2)

From Conference on Nuclear Energy, Public Policy and the Law, New York, May 1963.

Injuries to persons resulting from day-to-day operations of instruments containing radioisotopes used in industry, medicine, or research and injuries resulting from nuclear incidents in facilities producing, utilizing, or reprocessing nuclear materials are discussed from the point-of-view of tort liability and financial protection. (H.M.G.)

34191 LECTURE TO CONFERENCE ON NUCLEAR ENERGY, PUBLIC POLICY, AND THE LAW. T. J. Thompson. 21p. (CONF-98-1)

From Conference on Nuclear Energy, Public Policy and the Law, New York, May 1963.

Technical aspects of nuclear reactor function and operation are discussed with emphasis on safety precautions employed. Comments on public and legal policy governing reactor operation are made. It is concluded that important aspects of reactor safety, air safety, and like matters are far more technical than legal. (H.M.G.)

34192 REACTOR CONTAINMENT RESEARCH AND DEVELOPMENT. N. A. Weil (Illinois Inst. of Tech., Chicago). 21p. (CONF-39-83)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

An outline is given of containment concepts, sources and release rates of energy, responses of containment structures, effects of projectiles, and leakage rates of radioisotopes, with particular regard to major reactor accidents. (T.F.H.)

34193 RADIOPHOTOLUMINESCENT DOSIMETRY. Charles G. Amato, Stanley J. Malsky, and Bernard Roswit. 6p. (CONF-164-3)

From Society of Nuclear Medicine 10th Annual Meeting, Montreal, June 1963.

The use of silver-phosphate-activated glass as radiophotoluminescent in vivo dosimeters is discussed. (T.F.H.)

34194 THERMOLUMINESCENT DOSIMETRY. Stanley J. Malsky, Charles G. Amato, and Bernard Roswit. 11p. (CONF-164-5)

From Society of Nuclear Medicine 10th Annual Meeting, Montreal, June 1963.

The performance of CaF_2: Mn and LiF as thermoluminescent in vivo dosimeters is studied. The facility with which this type of dosimeter can be inserted into the body is discussed. The dosimeter is inserted into the body by trocar or catheter techniques and exposed to radiation; it is then removed and heated, and the thermoluminescence is measured and used as an indication of the absorbed dose. (T.F.H.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

Refer also to abstract 35217.

34195 (JLI-2748-O-7) HIGH DILUTION ON-STREAM ISOTOPIC TRACERS. Annual Report, March 1, 1962–October 31, 1962. (Johnston (William H.) Labs., Inc., Baltimore). Contract AT(30-1)-2748. 121p.

Towards the goal of automatizing the Deep Water Isotopic Current Analyzer (DWICA) for optimum unattended operation, the following devices were constructed: an Automatic Program Control System which automatically varies the repetition rate of radioisotope injection and provides a record of periods of resonance and other flow changes; the Electronic Servo Injector Control System which automatically adjusts the optimum amount of radioactivity at each injection; the Automatic Digital Convertor System which rapidly converts the collected data to digital form; and an Automatic Alarm System which stops injections and sounds a buzzer in the event of any abnormality of radioisotope detection. A fast, parallel entry 12-digit printer replaced the planned use of an absolute orientation transducer. The measurements taken in the Severn Estuary were theoretically analyzed. Calculation of the upstream velocity vector has permitted the determination of the integral representing the net motion of water upstream. Laboratory tests and technical analyses were performed concerning the design of a version of DWICA for use at great depths (up to 5000 ft). The problems of leakage, pressure control, detector seals and radiation penetration, cables and tranducers, orientation problems and power attenuation were considered and discussed with other collaborating groups. This work will utilize the portable americium neutron activator (PANACEA) unit. (auth)

34196 (MLM-1159) PROFILE MEASUREMENT OF THIN LAYERS OF ALPHA-EMITTING MATERIALS. R. G. Olt, T. E. Eyles, and A. W. Wotring (Mound Lab., Miamisburg, Ohio). June 18, 1955. Contract AT(33-1)-Gen-53. 10p.

Methods are introduced which measure profiles of thin layers of alpha-emitting materials up to 10 mg/cm^2 thick: nondestructive measurements by alpha counting and phosphor-enhanced pinhole autoradiographs resolved layer thickness at points 0.02 cm apart; accuracy with 5% could be obtained for layers of alpha activity 0.01 to 10 C/cm^2. (auth)

34197 GROWTH OF ASPERGILLUS ORYZAE IN IRRADIATED SUCROSE-NITRATE MEDIUM. M. L. Fields, G. R. Ammerman, and N. W. Desrosier (Purdue Univ., Lafayette, Ind.). Appl. Microbiol., 9: 110-12(Mar. 1961).

The nature of the growth medium is an important factor in determining the death of fungi by radiation. The effect of irradiated media on growth and spore germination of A. oryzae was investigated. Sucrose-nitrate medium in the dry or liquid form was exposed to 5.6-Mev electrons at doses up to 3.92 Mrad and inoculated with spores. Radiation changed the medium in such a manner as to stimulate (at 3.92 Mrad in dry form) or retard (3.92 Mrad in broth) the growth of A. oryzae. Growth was also retarded when A. oryzae was grown in sucrose-nitrate broth previously irradiated at doses of 0.436 to 3.05 Mrad. The growth on the nonirradiated control was not significantly different from growth at doses of 0.087 to 3.05 Mrad on the dry irradiated sucrose-nitrate medium. The results of the spore germination tests indicated that there was no significant difference between the germination of the spores of A. oryzae in the nonirradiated control medium and the broth which was radiated at a dose of 3.92 Mrad. All doses used here were in the range needed to preserve foods. In evaluating fungal growth on foods or other substrates which might be treated with radiation to prevent microbial growth, it is important to consider the effect of radiation upon the food and the direct effect of ionizing radiations upon the fungus. The present results emphasize the importance of changes in the medium on the growth variations of fungi. Although no stimulation of growth was indicated here at lower doses, other studies have indicated that low doses are stimulatory to fungal growth. (H.H.D.)

34198 ECONOMIC ASPECTS OF THE TECHNICAL APPLICATION OF RADIOISOTOPES. Atom, No. 81, 213-18(July 1963).

Ways in which the use of radioisotopes can affect the economy of industrial processes and some economic advantages of their use in public works are indicated. Results of national surveys in the USA and USSR on the economic advantages of using radioisotope techniques are discussed. Implications of the international survey presently being conducted by the International Atomic Energy Agency on economic aspects of radioisotope utilization are included. (H.M.G.)

34199 USE OF RADIOISOTOPES FOR THE FLOTATION OF COAL. Liboslav Simon. Jaderna Energie, 9: 202(1963). (In Czech)

Radicactive indicators were employed in the mining industry; in particular, tests were carried out in the Soviet Union on the interaction of flotation agents with coal by means of radioactive isotopes (V. J. Klassen et al., Ugol', 4-44(1961) No. 7). The method involves the comparison of the activity of the specimen with that of a known standard. Flotation agents were labeled with S^{32} and either dissolved or emulsified in hexyl, butyl, or ethyl alcohol or in petroleum distillates. Results of the radiometric method indicated that the flotation of coal may be carried out directly in dissolved inorganic salts, without adding other agents; thus, $CaCl_2$ solution was found to be adsorbed to a much greater extent on the coal than on the surrounding gangue. (TTT)

34200 LONG-TERM RAT FEEDING STUDIES ON IRRADIATED CHICKEN STEW AND IRRADIATED CABBAGE. A. W. Phillips, H. R. Newcomb, and D. R. Shanklin (Univ. of Syracuse, N. Y.). Toxicol. Appl. Pharmacol., 5: 273-97(May 1963).

Chicken stew was exposed to sterilizing doses of Co^{60} γ radiation and cabbage to pasteurizing doses. Evaluation for wholesomeness was made by feeding to four successive generations of rats. The stew (0, 2.79, and 5.58 Mrad) and raw cabbage (0, 279, and 558 krad) were combined, each at 35% of the final diet solids, with other nonirradiated ingredients to provide a nutritionally adequate ration. Before use in diet preparation, the irradiated chicken stew was stored at 75°F, control stew at 5°F for 3-6 months, and both irradiated and control cabbage at 35-40°F for 2-4 weeks.

Soon after weaning, parent-generation rats were then given the diets for 104 weeks: succeeding generations were fed for shorter periods. Growth of parent-generation rats was not influenced by the irradiated foods, nor generally that of second- and third-generation animals. No effects were observed on the reproductive performance of three generations or on longevity of parent-generation animals. Pathologic and hematologic findings were similar in test and control animals. Rats fed both foods treated with max dose manifested the following significant changes in duodenal enzymes: decreased levels for alkaline phosphatase in both sexes and monoamine oxidase in females, increased alanyl-β-aminopeptidase and 2-naphthyl octanoate esterase activity in females. Sucrase, glutamic-oxalacetic and glutamic-pyruvic transaminases were unaffected by feeding irradiated foods. In contrast to these results on young rats, adult animals given the irradiated food failed to show any effects upon intestinal mucosal levels of hexokinase, sucrase, alkaline phosphatase, and glutamicoxalacetic transaminase. The incidence of tumors was similar in both experimental and control groups. It is concluded that growing rats are more sensitive than adult rats to factors that alter tissue enzyme activities. (H.H.D.)

34201 INCREASED NUMBER OF COFFEE BEANS PRODUCED FROM IRRADIATED SEEDS. Fernando Monge (Instituto Interamericano de Ciencias Agricolas, Turrialba, Costa Rica). Turrialba, 12: 209-12(Oct.-Dec. 1962). (In Spanish)

A genetic analysis of coffee plants from neutron and x-irradiated seed reveals that peaberry percent increased with radiation dose applied. The response for neutron irradiated plants was linear whereas for the x ray treatments it was exponential. This suggests that the high frequency of peaberries obtained from irradiated plants is due to chromosomal aberrations that cause gamete elimination and thus, a high production of one-seeded fruits. (auth)

34202 PREDPOSEVNOE OBLUCHENIE SEMYAN SEL'SKOKHOZYAISTVENNYKH KUL'TUR. MATERIALLY NAUCHNOI KONFERENTSII MOSKVA, 20-23 FEVRALYA 1961 GODA. (Pre-Sowing Irradiation of Seeds in Agricultural Crops. Reports of Scientific Conference, Moscow, Feb. 20-23, 1961). A. M. Kuzin. Moscow, Publishing House of the Academy of Sciences, 1963. 216p.

Thirty-four papers are included on the irradiation of agricultural seed grains prior to sowing. Papers deal with methods of irradiation, mechanisms of radiation effects, radiation growth stimulation, and biochemical effects. Data are given on radiation effects on growth and harvest of sugar beets, maize, cotton, and truck garden vegetables. (R.V.J.)

34203 INDUSTRIELL ISOTOPTEKNIK. (Industrial Isotope Technique). Lars G. Erwall, Hans G. Forsberg, and Knut Ljunggren. Copenhagen, Munksgaard, 1962. 302p.

The industrial applications of radioisotopes are discussed. Included are the physical and chemical background of radioisotope application: nuclear structure, radiation and its interaction with matter, nuclear reactors and isotope production, and measuring instruments for radiation. Also the technical uses of radioisotopes: radioisotopic labeling, tracer technique, chemical and metallurgical analysis, neutron activation, medical and hygienic aspects of radiation protection, and laws and regulations concerning transport and handling of radioactive material are discussed. A comprehensive bibliography, a list of the industrially important radioisotopes and their characteristics, their decay schemes, nomograms for the calculation of radiation absorption and examples of practical applications are appended. (TCO)

34204 A STATISTICAL CORRELATION OF NEUTRON SCATTERING BY PROTON INTERACTION FOR DETERMINING THE MOISTURE CONTENT. H. S. Senturk and C. Cansoy (Turkish Highways Dept., Ankara). 10p. (CONF-74-12)

From International Symposium on Humidity and Moisture, Washington, D. C., May 1963.

Attempts were made to derive a mathematical correlation between water content and neutron scattering by statistical considerations. Such considerations show that the ratio of moderated neutrons scattered to the total original neutrons is a function of the total water content of the scattering medium. A characteristic feature of the function is that it approaches an asymptotic value as the water content increases indefinitely. However, the function has no practical meaning beyond a concentration that is equal to that of pure water. (P.C.H.)

34205 MEASUREMENT OF MOISTURE IN RAW MATERIALS FOR IRON MAKING BY NEUTRON SLOWING DOWN. Yoshio Miyashita (Japan Steel and Tube Corp., Kawasaki, Japan). 20p. (CONF-89-5)

From International Symposium on Humidity and Moisture, Washington, D. C., May 1963.

The nuclear method was tried to be put to practical uses in determining the moisture content of raw materials for iron making processes including sinter mix, coke, and iron ore for blast furnace charge. The factors that may affect the output of the moisture meter were examined and the plant experiments were also made. It is concluded that it is possible to measure the moisture of raw materials by means of neutron thermalization and to control it using the indications. Changes in the chemical composition and the grain size distribution of measured material do not matter significantly, while the changes of the density are serious. It is therefore desirable to keep the density constant or, when such is impossible, to correct the output with density. (auth)

34206 A STATISTICAL CORRELATION OF NEUTRON SCATTERING BY PROTON INTERACTION FOR DETERMINING THE MOISTURE CONTENT. H. S. Sentuerk, comp. 23p. (CONF-89-2)

From International Symposium on Humidity and Moisture, Washington, D. C., May 1963.

The mathematical correlation between water content and neutron scattering is derived from statistical considerations. It is shown that the ratio of moderated neutrons scattered to the total original neutrons is a function of the total water content of the scattering medium. A characteristic feature of this function is that it approaches an asymptotic value as the water content increases indefinitely. This method can be used to determine moisture content in construction materials. (C.E.S.)

INSTRUMENTS AND INSTRUMENTATION

General and Miscellaneous

Refer also to abstracts 33842 and 34428.

34207 (EUR-362.f) REALISATION D'UN DETECTEUR DE BURN-OUT. (Burnout Detector Realization). P. Herzberger and R. Morin (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 58p.

A burnout detector using a Wheatstone bridge is described. The signal coming from the bridge diagonal is amplified and filtered. At the output of amplifier and filter only pulses which correspond to the slope du/dt of signals generated by the burn-out detector remain. This solution allows slight variations of the bridge signals, false signals generated by harmonics of the bridge input, and parasites coming from switch processes to be eliminated. On the other hand, according to the improvements of the system, the true calibration of the bridge and the permanent control by an operator are not necessary. A method of calculation of the detector is described. The annex shows some test results already obtained by the system. (auth)

34208 (NP-13028) DEVELOPMENT AND DESCRIPTION OF A NOVEL METHOD FOR ACCURATE MEASUREMENTS OF FLUID FLOW RATES. Kurt M. Becker and Gunnar Hernborg (Aktiebolaget Atomenergi, Stockholm). Nov. 21, 1961. 13p.

A flowmeter system based on measuring the pressure drop for flow through a straight smooth duct was developed to measure water flow rates as low as 1 to 25 l/min with an accuracy of better than 1%. The flowmeter, its calibration, and the establishment of calibration charts are discussed. (D.C.W.)

34209 AN INTERFEROMETER FOR PRECISION ANGLE MEASUREMENTS. J. Rohlin (Chalmers Univ. of Tech., Gothenburg, Sweden). Appl. Opt., 2: 762-3(July 1963).

An angle measuring interferometer of the Michelson type, constructed for use primarily with a gamma diffraction spectrometer, is described. The interferometer, which has a sensitivity of 0.1 sec of arc on a measuring range of 30°, is designed with plane mirrors as end reflectors and a cube corner prism as the movable unit. The interferometer operates with a continuously varying glass compensation. Several geometrically different arrangements of the components are possible. (C.E.S.)

34210 MICROPARTICLE DIODES. Ch. Maisonnier and M. Haegi (Euratom-CNEN, Rome). J. Appl. Phys., 33: 2474-8(Aug. 1962). (EUR 315.e)

Using a simple model, the motion of an ensemble of small conducting spheres located between two parallel electrodes was investigated theoretically in the case where the flow is space-charge-limited. A more realistic but more complicated model is proposed. The experimental apparatus used to check the theoretical predictions is described; agreement between theory and experiment is fair. Possible applications of such diodes are mentioned. (auth)

34211 STUDY OF AMPLITUDE FLUCTUATIONS IN PHOTOMULTIPLIERS. Marcel Brault and Claude Gazier (Laboratoires d'Électronique and de Physique Appliquée, Paris). J. Phys., 24: 345-6(May 1963). (In French)

Statistical fluctuations of the gain of a photomultiplier are studied experimentally as a function of the dynode voltage distributions. (T.F.H.)

34212 AN AUTOMATIC X-RAY ISODOSE PLOTTER. D. Greene and K. A. Nelson (Christie Hospital and Holt Radium Inst., Manchester, Eng.). J. Sci. Instr., 40: 381-4 (Aug. 1963).

The isodose curves representing the dose distribution in water exposed to a broad x-ray beam are plotted by recording the path of a small ionization chamber, which automatically follows preselected isodose lines, in the water. The device is described, and design factors determining the accuracy of the results are discussed. (auth)

34213 A SPARK GAP FOR SWITCHING GREAT CAPACITIES. Jaroslav Král (Inst. of Nuclear Physics, Czechoslovak Academy of Sciences, Prague). Jaderna Energie, 9: 227-32(1963). (In Czech.)

A review of some switching spark gaps used in devices for the investigation of high-temperature plasma is given. Characteristic values and properties of switching spark gaps are enumerated in relation to needed demands. (auth)

34214 PERFECT FOCUSING MASS SPECTROMETER. Tatsuo Arikawa (Tokyo Univ.). Japan J. Appl. Phys., 2: 420-8(July 1963).

A perfect focusing mass spectrometer was investigated and the tests were carried out with electrons in the energy range up to 1 kev concerning both properties of the perfect velocity focusing and of the perfect direction focusing. A luminous intensity of more than 95 percent was obtained experimentally for $s = 1$, where s is a field parameter connecting the electric and the magnetic fields. In addition, the resolving power of this spectrometer was experimentally studied and compared with theoretical results. (auth)

34215 AN ELECTRON SPIN RESONANCE SPECTROMETER USING THE AMMONIA MASER AS A PRE-AMPLIFIER. W. A. Gambling and T. H. Wilmshurst (Univ. of Southampton, Eng.). Phys. Letters, 5: 228-9(July 15, 1963). (In English)

An electron-spin-resonance spectrometer is described with which an improved sensitivity has been obtained at low power levels by using an ammonia maser as a low-noise pre-amplifier. The arrangements for maintaining the necessary frequency stability (300 c/s in 23 kM c/s) and for avoiding saturation (saturation power = 10^{-12} w) are indicated. Preliminary measurements show that the sensitivity is 3×10^{-12} ΔH spins with a generator power of 30 μw. (R.E.U.)

34216 TRANSDUCERS FOR IN-CORE NUCLEAR REACTOR MEASUREMENTS. J. J. Loving and D. F. Winters (Westinghouse Electric Corp., Pittsburgh). 13p. (CONF-91-2)

From 6th National Power Instrumentation Symposium, Philadelphia, May 1963.

Techniques for measuring neutron and gamma fluxes and coolant temperatures, pressures, and flows in experimental power-producing commercial-type reactors are discussed. Problems encountered at the Saxton Power Reactor are outlined, and steps taken for their solution are discussed. (T.F.H.)

34217 THERMOCOUPLE, e.g. FOR FUEL ELEMENTS IN NUCLEAR REACTORS. Gideon Sorsky and F. Alan Cusworth (to British Insulated Callender's Cables Ltd.).

German Patent 1,149,761. June 6, 1963. Filed Nov. 3, 1960.

A thermoelement cable is described which tears at a predetermined spot along its length when stretched longitudinally so that a certain stress is surpassed. The cable is made to form a loop held together by a steel wire which is attached to the cable at both ends. The steel wire tears at a stress far below the breaking load of the stretched wire and the cable is elongated. (Gmelin Inst.)

34218 TEMPERATURE MEASURING METHOD AND APPARATUS. Lyle B. Borst (to North American Philips Co., Inc.). U. S. Patent 3,099,745. July 30, 1963. Filed Apr. 25, 1960.

A method for measuring the temperature of a substance by introducing neutrons and causing these neutrons to penetrate deep and undergo sufficient collisions with the nuclei to attain thermal equilibrium with them is presented. The energy of the emerging neutrons is measured to obtain an indication of the temperature of the substance. The energy of the neutrons is compared with neutron energies at a known temperature. (C.E.S.)

34219 LOW NOISE ELECTRON BEAM PLASMA AMPLIFIER. John Melvin Anderson (to General Electric Co.). U. S. Patent 3,099,768. July 30, 1963. Filed Mar. 25, 1959.

An electronic amplifier utilizing an electron beam-gaseous discharge plasma interaction for amplifying electromagnetic signals is presented. For minimizing the introduction of noise in the output signal the interacting plasma utilized is that in the negative glow portion of the discharge. The interacting electrons in this region are of relatively low temperature and energy and contribute only negligibly to production of noise in the amplification process. (C.E.S.)

Radiation Detection

Refer also to abstracts 34146, 34863, 34864, 34869, 35098, and 35183.

34220 (AERE-M-945) THE MEASUREMENT OF GAMMA-RAY ACTIVITY AT LOW LEVELS OR AT LOW CONCENTRATIONS IN BULK SAMPLES. J. Rundo (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). July 1963. 10p.

The application of gamma-ray spectrometry using thallium-activated sodium iodide crystals to the measurement of weak sources of radioactivity is discussed. Topics considered are instrumentation (detector, shield, and electronic equipment), counter background (nature, stability, and effect of sample), calibration, and limits of detection. 46 references. (auth)

34221 (ANL-6737) VARIANCE IN SCINTILLATOR LIGHT COLLECTION. George A. Sinnott and William A. Managan (Argonne National Lab., Ill.). June 1963. Contract W-31-109-eng-38. 7p.

A Monte-Carlo program for the "GEORGE" Computer at Argonne National Laboratory was used to compute the average path length and number of diffuse reflections of a light ray originating at a given point in a cylinder before it is absorbed in a "black" concentric circle in the bottom of the cylinder. The variance of these numbers is estimated and indicates light-trapping effects. Total internal reflection at the exit ("black") interface is included. The average number of reflections increases rapidly as the crystal length exceeds one diameter. (auth)

34222 (CONF-39-39) ON LINE REACTOR SAFETY MONITOR FOR RAPID DETECTION AND DIAGNOSIS OF REACTOR SYSTEM INSTABILITIES. R. L. Randall (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). [1963]. Contract AT(11-1)-Gen-8. 16p.

From American Nuclear Society Meeting, Salt Lake City, June 1963.

The Multichannel Noise Analyzer System (MNA) is a device which simultaneously measures the spectral density of noise at 40 frequencies in $\frac{1}{3}$ octave steps with $\frac{1}{3}$ octave bandpass filters from 0.005 to 50 cps. The instrument can be used as an on-the-line reactor transfer function monitor or a safety monitor which continuously displays and records the frequency dependence of the fluctuations or noise in any reactor core variable. MNA is described and test results of its use are presented. MNA can determine the cause and extent of any mechanical, thermal, or coolant instability by comparing the spectral density of neutron level with other core variables such as fuel temperature, coolant temperatures, primary flow rate, power line modulation, pressure, vibration, and tape recorded signals. The device can supply a signal for a warning device, a reactor shutdown mechanism, or an adaptive control system where it is necessary to drive a reactor to maximum power levels consistent with safety. (N.W.R.)

34223 (CERN-63-23) PROCEEDINGS OF THE INFORMAL MEETING ON GEOMETRY PROGRAMMES FOR HEAVY LIQUID BUBBLE CHAMBERS HELD AT CERN, MAY 21, 1963. M. Nikolič and V. Cooper, eds. (European Organization for Nuclear Research, Geneva). July 3, 1963. 202p.

Separate abstracts were prepared for the eleven papers on computer programs for analyzing and reconstructing events in heavy liquid chambers and on the measurement of electron and gamma energies and electron track lengths. (D.C.W.)

34224 (CERN-63-23(p.5-37)) THRESH — BASIC CERN GEOMETRY PROGRAMME. A. M. Cnops (European Organization for Nuclear Research, Geneva).

The program THRESH for the geometrical reconstruction in space of events in hydrogen is described. Points are reconstructed in space, taking into account the refraction of the light rays in the different media, and a least squares fitting procedure gives the helix fitting the points. Modifications to THRESH for heavy liquids for which the helical approximation is inaccurate are given. (D.C.W.)

34225 (CERN-63-23(p.39-45)) A POSSIBLE SIMPLIFIED FITTING PROCEDURE IN THRESH FOR HEAVY LIQUIDS. W. G. Moorhead (European Organization for Nuclear Research, Geneva).

Fitting procedures that can be used with the THRESH program for heavy liquids for which the helical description is inaccurate are outlined. The procedures are taken from the FOG program, the near corresponding points method of which is described. Suggestions for improving the fits are included. (D.C.W.)

34226 (CERN-63-23(p.47-52)) CERN EXPERIENCE IN USING THRESH FOR HEAVY LIQUID CHAMBERS. B. Ronne (European Organization for Nuclear Research, Geneva).

Some 1500 tracks or pieces of tracks from Ξ^- events have passed through THRESH. Only about 10% of the events had to be remeasured because the tracks did not converge in THRESH, and only one track had to be remeasured 3 times before it converged. Performance of the REAP, JOIN, and GRIND programs used with THRESH is sum-

marized, and internal errors in THRESH are given. (D.C.W.)

34227 (CERN-63-23(p.53-8)) THE GEOMETRY PROGRAMME FOR HEAVY LIQUID IN USE AT THE UNIVERSITY OF MILAN. M. di Corato (Milan. Università).

Modifications of the GAP program from its hydrogen version to facilitate geometrical reconstruction of tracks for events in heavy liquid bubble chambers are described along with the code's operations. Its performance is also indicated. (D.C.W.)

34228 (CERN-63-23(p.59-92)) THE GEOMETRY PROGRAMME BULLE □ OF THE ECOLE POLYTECHNIQUE AND EXPERIENCE IN ITS USE. J. Hennessy (Paris. Ecole Polytechnique and Collège de France, Paris).

The computer program BULLE that determines the momentum and directions of bubble-chamber tracks measured by an IEP-type device is described. The method used, numerical procedures, and operating experience are discussed. Only about one track in ten was rejected from about 10,000 tracks run on the program. (D.C.W.)

34229 (CERN-63-23(p.93-117)) THE HEAVY LIQUID GEOMETRY PROGRAMME IN USE AT THE RUTHERFORD LABORATORY. J. Sparrow (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Chilton, Berks, England).

The program RHEL for analysis of bubble chamber event geometries is discussed. Space point reconstruction and space fitting to obtain kinematical quantities are outlined, and modifications to the hydrogen version to permit treatment of heavy liquid events are described. In the processing of about 200 Ξ^- events, a pass rate of about 60% was obtained on the first attempt. (D.C.W.)

34230 (CERN-63-23(p.119-46)) RANGE PROGRAMME. G. Rinaudo and A. E. Werbrouck (Italy. Istituto Nazionale di Fisica Nucleare, Turin).

The program RANGE, in FORTRAN for the IBM 7090, determines the range of tracks that turn through large angles, display significant curvature along the track, and undergo considerable multiple scattering. The entire track is measured in three views, and each point is reconstructed in the two optimum combinations. Addition of track segments and introduction of corrections for statistical errors and multiple scattering give the range. Spatial reconstruction, range determination, and Monte Carlo corrections are outlined. (D.C.W.)

34231 (CERN-63-23(p.147-56)) A NEW GEOMETRY PROGRAMME. M. Huybrechts.

The program STAN reconstructs points in space from the measurements of non-corresponding points and estimates parameters characterizing the track. Estimation of curvature, dip angle, range, energy loss, and the tangent at the apex are discussed, as well as the error matrix and kink detection. The program analyzes tracks differing from a helix and does not require measurement of the tracks in segments. (D.C.W.)

34232 (CERN-63-23(p.157-66)) MESURE PAR COURBURE DE L'ENERGIE DES ELECTRONS DANS LES CHAMBRES A LIQUIDES LOURDS. (Measurement of Electron Energy by Curves in Heavy Liquid Chambers. L. Behr and P. Mittner (Paris. Ecole Polytechnique).

Energy measurements for electrons spiralling in a magnetic field require corrections due to radiative emission by the electrons. A method for determining the corrections and estimating the uncertainty in the momentum determination is discussed. Minimization of the uncertainty in the measurement is considered. (D.C.W.)

34233 (CERN-63-23(p.167-71)) MEASUREMENT OF THE TOTAL TRACK LENGTH OF ELECTRON SHOWERS USING A NEW FIRST APPROXIMATION IN THRESH. H. Burmeister (European Organization for Nuclear Research, Geneva).

An energy-track length relation is discussed, and a method for measuring the track length is described. (D.C.W.)

34234 (CERN-63-23(p.173-97)) MEASUREMENT OF γ-RAY ENERGY IN A Xe BUBBLE CHAMBER. O. Czyzewski, J. A. Danysz, and Z. Strugalski (European Organization for Nuclear Research, Geneva).

A method for making γ-ray energy measurements at 20 to 1000 Mev is described. The proportionality of the primary photon energy to the sum of the electron ranges (ΣR) produced in a shower is utilized. Curves showing the dependence of the photon energy on ΣR and on shower development lengths are included, and errors in the method are discussed. (D.C.W.)

34235 (EUR-300.f) UTILISATION DES COMPTEURS PROPORTIONNELS AU FB_3 POUR LA DETECTION DE FLUX DE NEUTRONS FAIBLES EN PRESENCE DE HAUTS FLUX GAMMA. (Utilization of Proportional Counters Containing BF_3 for Detecting Weak Neutron Fluxes in the Presence of High Gamma Fluxes). J. Fleury (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 47p.

The possibilities of discriminating between a low neutron flux (from 0.1 up to 10 n/cm^2/sec) with proportional BF_3 counters were studied; the best solution consists of reducing the effect of gamma pile-up with a special electronic device, including in the linear amplifier, a double RC differentiation, as short as possible. Some theorical considerations determine the minimum differentiation to use, when the noise level of the preamplifier, and the fluctuations of the pulse shape, due to the variable collection times of the primary electrons on the counter wire are known; good agreement of this result with experience was found. If a counter not too big, filled at low pressure of BF_3 (20 cm Hg), can be used it is possible to discriminate between a unit neutron flux and a gamma flux of 200 R/H, using a 10 M Hz amplifier with a double RC differentiation of 2 10^{-7} sec. (auth)

34236 (ORO-589) INVESTIGATION OF A GEIGER COUNTER TECHNIQUE FOR DETERMINING THE POSITION IN SPACE OF INDIVIDUAL IONIZING PARTICLES. Final Report. R. L. Ely, Jr., and H. G. Richter (Research Triangle Inst., Durham, N. C.). June 30, 1963. Contract AT(40-1)-2513. 35p.

The behavior of multiple anodes in a flat Geiger counter was studied. It was observed that two parallel anodes in a flat counter, operated at different voltages in the Geiger region, will exhibit the same counting-rate when each is at the same voltage but otherwise that anode with the lower voltage will exhibit the higher counting-rate. This observation can be satisfactorily explained by photo-induced discharges if one assumes that the higher the voltage on an anode, the greater is the probability that it will induce a discharge on the adjacent anode. With anodes 10 cm long spaced 2 cm the photo-induced counting-rate on an anode was about 0.2% of the counting-rate of the adjacent anode per volt above a threshold value that appeared to be 50–100 volts above the Geiger threshold. This does not appear to be a strong function of the anode spacing in the range 0.5 to 2 cm. However, another effect is observed which is more dependent upon spacing. At one cm spacing or less, the anode with the higher voltage tends to suppress the plateau

of the adjacent anode, raising its threshold voltage and decreasing the plateau counting-rate. The compounded result of these two effects is a function of the spacing and the anode voltages. Several other effects are described for which there are no immediate explanations. (auth)

34237 (RISÖ-60) A THERMAL NEUTRON COUNTER OF WELL KNOWN DETECTION EFFICIENCY. J. Als-Nielsen and A. Bahnsen (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). May 1963. 29p.

A proportional counter was developed utilizing the $He^3(n,p)H^3$ reaction (Q = 764 kev) for measuring neutron density in a thermal beam. The counter has a rectangular cross section, and the anode wire is perpendicular to the beam, which can then traverse either the short (3 cm) or the long (5 cm) dimension of the counting chamber. In both cases, the maximum energy loss from ionization tracks, shortened at the walls, will be $^3/_4$ Q – reaction particles being expelled in opposite directions. All (n,p) reactions will therefore be counted with a discriminator level below $^1/_4$ Q. Detailed calculations of the wall-effect spectrum exhibit a step at $^1/_4$ Q, and this is clearly demonstrated by the measurements, which also show that it is possible to discriminate effectively against background. Spectra, recorded at 1 and 2 atm of gas pressure, agree very well with the calculated, and the difference between the spectra for the two counter lengths is very close to that expected from a wall-less counter, indicating that conditions in the counter are close to ideal. The ratio between the counting rates of the long and the short dimension of the counter, was compared to the ratio between the physical lengths, and good agreement found. It is concluded that detection, i.e. the ratio between number of counts and number of (n,p) reactions, is equal to 1.000, with an uncertainty of ±0.4%, for both counter orientations. (auth)

34238 (RT/FI(63)25) A FAST-CYCLING CLOUD CHAMBER. G. M. de'Munari, G. Mambriani, and A. Vecli (Italy. Istituto Nazionale di Fisica Nucleare, Milan and Milan. Universita. Istituto di Fisica). Apr. 1963. 12p.

A cloud chamber in which the gas of the chamber is renewed after every expansion is described. Short dead times of 10 sec have been obtained by this method. (auth)

34239 (UCRL-10770) INVERSION MATRIX FOR A HELIUM-3 FAST-NEUTRON SPECTROMETER (thesis). Hsien-Tsan Wang (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 23, 1963. Contract W-7405-eng-48. 109p.

A general method for calculating the inversion matrix for a helium-3 fast-neutron spectrometer is obtained by analyzing the wall effect, the recoil effect, and the $He^3(n,d)D$ effect. The dependence of the inversion matrix and the counter efficiency on the filling-gas pressure and the counter dimensions is also presented. A computer program that computes the response matrix and inverts it for the case of a 10-atmosphere-pressure neutron detector is included as an example. (auth)

34240 (USNRDL-TR-654) SUPPLEMENTARY ESTIMATES OF RADIATION GEOMETRY AND ENERGY RESPONSE FOR USNRDL GAMMA-INTENSITY-TIME RECORDER (GITR) MODEL 103. H. R. Rinnert (Naval Radiological Defense Lab., San Francisco). May 13, 1963. 41p.

Estimates of radiation response are presented for the Model 103 Gamma-Intensity-Time Recorder (GITR) as used at Operation Sunbeam. The GITR detector unit, consisting of two concentric ionization chambers, was mounted inside the GITR recorder case and located 3 ft above ground level. GITR responses and their time-dependence were estimated for several idealized radiation source geometries and several calculated gamma energy spectra. Estimated response values are presented as fractions of the GITR's calibration response to Cs^{137} radiation beamed at the top of the unmounted detector along its longitudinal axis. The principal conclusions drawn were that: (1) The GITR responses to distributed sources with specified gamma energy spectra did not show a significant dependence upon the source geometries investigated. (2) There were about 17% differences between the responses of the two concentric detectors. (3) The responses changed about 15% during the first 100 hours after fission. (4) The use of overall average GITR responses for distributed sources seems warranted; there is 95% confidence that 95% of the population of GITR responses will be within 12% of the overall average response of 1.16 for the high-range detector, and within 14% of the overall average response of 0.99 for the low-range detector, during the first 110 hours after fission. Because these response values are measures of the bias in the GITR calibration technique, the bias can be corrected (or at least minimized) by dividing the recorded GITR data by the above-mentioned overall average GITR response values. (auth)

34241 (UCRL-Trans-984) THE HIGH-PERFORMANCE FLUOROGLASS DOSIMETER. Ryosuke Yokota and Saburo Nakajima. Translated for Univ. of California, Lawrence Radiation Lab., Berkeley from Toshiba Rebyu, 18: No. 2, 1-9(1963). 34p.

A new optical system was devised which takes into account measurement errors and is based upon their consideration. This system is not sensitive to contamination of the fluoroglass and limits the predose fluorescence of the fluoroglass holder to a value lower than 3% of that in Type 3. The mechanical accuracy also was improved. Measurements were made feasible in three successive positions of the holder. For the electrical section, the zero-detecting method is utilized for the sake of accuracy. The badge case and finger-ring case for the measurement of x and γ rays and handling case for the fluoroglass and badge case also were newly developed. As a result of these new devices, the measurement reproducibility is considerably enhanced. Type FD-R1-1 (1 mm φ × 6 mm) glass has accuracies of ± 15% for 10 mrad, ±6% for 25 mrad, and ±2% for 50 mrad of γ rays. Exposure dose measurement with Type FD-P8-1 involves very little fading and its directional dependence is also small. Accordingly, it may be called an ideal measurement of individual doses. A high-performance holder for Type FD-R1-1 (1 mm φ × 6 mm) was developed. With this device, measurement accuracy is remarkably improved, with only 0.7% standard deviation at 100 rad. The effect of contamination is minimized. A gold sheath case for the rod which is useful for in vivo dosimetry also was developed. A method was devised to measure the absorbed dose by extrapolating the data to correspond to the glass of zero thickness. (auth)

34242 SPARK CHAMBER FOR COSMIC-RAY DEMONSTRATIONS. James A. Earl (Univ. of Minnesota, Minneapolis). Am. J. Phys., 31: 571-5(Aug. 1963).

A simple, flexible, and easily constructed design for small spark chambers is given. An inexpensive electronic circuit used to trigger the spark chamber is also described. (auth)

34243 COMPENSATION TYPE WATER FLOW CALORIMETER FOR INTENSE ELECTRON BEAMS. II. CASE OF 5-20 Mev ELECTRON BEAMS. Shigeru Okabe, Kuni-

hiko Tsumori, and Keisuke Kawabata. Ann. Rept. Radiation Center Osaka Prefect., 3: 58-9(1962). (In English)

The results of experiments on a compensation-type water-flow calorimeter at 5 to 20 Mev and output power of 200 to 4000 watts are reported. A case of low beam current and one of intense beam current are described. (P.C.H.)

34244 DAMAGE IN A SOLID STATE DETECTOR BY FAST NEUTRONS. R. J. Schuttler and J. P. Noel (Centre d'Etudes Nucléaires, Fontenay-aux-Roses, France). Brit. J. Appl. Phys., 14: 527(Aug. 1963).

Measurements of the resolution of barrier surface junction silicon detectors for alpha particles before and after neutron irradiation showed that the neutron damage caused a resolution broadening of 15 kev for an integrated dose equivalent to 10^{13} neutrons/cm^2. (D.C.W.)

34245 NUCLEAR INSTRUMENTATION. NO. 17. Bull. Inform. Sci. Tech. (Paris), No. 71, Suppl., 1-46(Apr. 1963). (In French)

The principal modifications made to the standards for transistor nuclear electronics are summarized. The design and properties of the HYPEAC interferential spectrometer are described in detail. The new instruments designed and constructed by the C.E.A. are discussed. The instruments considered are detectors, counting devices, monitoring devices, prospection devices, and recording potentiometers. (J.S.R.)

34246 A METHOD FOR THE DETERMINATION OF THE MOMENT OF A HIGH-ENERGY PARTICLE IN AN IONOGRAPHIC EMULSION. Claudette Patou, Jacques Bermond, and Maurice Scherer (Faculté des Sciences, Caen, France). Compt. Rend., 257: 111-14(July 1, 1963). (In French)

A method is proposed for the determination of the moment of high-energy particles in ionographic emulsions, which permits any number (≥3) of cell lengths to be used in the elimination of the parasitic scattering. The principle of the method is described, and experimental results on individual tracks produced by a π^- beam at 8.2 ± 0.4 Bev are presented. (J.S.R.)

34247 SPARK CHAMBERS. D. F. Bacon and W. F. Nash (Nottingham Univ., Eng.). Contemp. Phys., 4: 356-72(June 1963).

The evolution, merits, and operational principles of spark chambers are reviewed, and practical aspects of their design and use are discussed. Special electrode configurations, development of electronic data transfer from spark chambers, and future prospects in the latter area are briefly considered. (D.C.W.)

34248 WIDE-RANGE RADIATION MONITOR FOR CIVIL PROTECTION. Agustin Tanarro Sanz and Fermin Navascués Navascués. Energia Nucl. (Madrid), 7: No. 25, 4-16(Jan.-Mar. 1963). (In Spanish)

A simple, light, sturdy radiation monitor with a wide detection range, designed for civilian use, is described. The instrument can measure γ levels between 1 mr/hr and 10 r/hr. The monitor can be fed by line voltage or by batteries. The detection circuit, amplifier and pulse integrator circuit, the operation circuit, alarm circuit, and feed circuit are discussed and shown diagrammatically. (J.S.R.)

34249 INVESTIGATION OF THE SUN'S X-RAYS. III. ELECTRONIC APPARATUS. B. N. Vasil'ev, A. I. Shurigin, I. P. Tindo, and Yu. K. Voron'ko. Iskusstv. Sputniki Zemli, Akad. Nauk SSSR, No. 15, 85-91(1963). (In Russian)

The electronic portion of an apparatus constructed for the investigation of soft x rays being emitted by the sun is described. The apparatus is used in geophysical rockets and in cosmic space ships and earth satellites. In the geophysical rockets two separate detection channels are employed, one for the working counters and the other for the control counters. The working counter is always directed towards the sun while the control counter is turned 15° away from the sun. In the second Sputnik six identical counters were used and arranged so that their line of sight was oriented along three mutually perpendicular axes. In the third Sputnik the working and control counters were distributed in a system which was self-orienting with respect to the sun. In addition, two stationary counters were employed; their direction with respect to the sun changed during the course of the flight. The electronic apparatus consists of the following basic components: a circuit that forms the amplitude and shape of the counter pulses, the triggering device, the separating cascade circuit, and the coding set-up. Each of these circuits is described in detail; block diagrams are shown. (TTT)

34250 VARIATION WITH IONIZATION DENSITY OF THE BRILLIANCE OF SPARKS ALONG A PARTICLE TRACK IN A SPARK CHAMBER. Bernard Agrinier, Yves Koechlin, Bruno Parlier, and Philippe Catz (CEN, Saclay, France). J. Phys., 24: 312-14(May 1963). (In French)

During experimentation with a lead-plate spark chamber built for the detection of primary cosmic electrons, the brightness of a single particle track slowing down in the lead plates is observed to vary with the ionization density of this particle. This effect is visible only if all the high-voltage plates are fed from the same condenser. The possibility of recording simultaneous tracks of particles of very different ionization density with a good efficiency is closely related to precision in gap length and other discharge conditions. (auth)

34251 COMPENSATION OF THE EARTH'S MAGNETIC FIELD FOR AN IRON-FREE DOUBLE-FOCUSING SPECTROMETER WITH A ONE METER RADIUS. J. Kouloumdjian and J. Lafoucriere (Institut de Physique Nucléaire, Lyon). J. Phys., 24: 327-9(May 1963). (In French)

Compensation of the earth's magnetic field in a one-meter-radius, iron-free, double-focusing spectrometer is described. The compensation is made by means of two coaxial pairs of coils. The earth's magnetic field is annulled with a precision better than one part in 10^{-4}, in the whole volume of the vacuum chamber. (auth)

34252 A HIGH-VOLTAGE SOURCE FOR RADIOACTIVE RADIATION DETECTORS. Jirí Boucek and J. Kubálek (Biophysical Inst., Prague). Jaderna Energie, 9: 203-6(1963). (In Czech)

A high-voltage supply source was developed to be employed for feeding nuclear measuring instruments, in particular in the medical and biological fields. The instrument is of simple and rugged construction and may be universally applied. The high-voltage output was found to vary only slightly as the line voltage was changed from 160 to over 220 v, as steps were taken to stabilize the anodic oscillations. This excellent stability makes it suitable to use the source for scintillation spectroscopy. The upper range of the instrument extends to 2500 v. (TTT)

34253 DEVELOPMENT OF NEW GAS DISCHARGE COUNTERS FOR RADIOMETRIC EQUIPMENT. A. Tumul'kan (Academy of Sciences, Latvia SSR). Latvijas PSR Zinatnu Akad. Vestis, No. 4, 90-100(1963). (In Russian)

Means for improving the efficiency of gas discharge

counters for γ- and x-ray recording are discussed, and the feasibility of using non-selfquenching counters in relay installations is analyzed. The design of a new multisectional counter with plane-parallel electrode geometry is given, and preliminary data on the time and current characteristics are plotted. (R.V.J.)

34254 REDUCTION OF THE TIME UNCERTAINTY IN NEUTRON FLIGHT TIME MEASUREMENTS. András Ádám, Gabriella Pálla, and Pál Quittner. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 11: 197-204(1963). (In Hungarian)

A time-to-pulse-height converter was built for the measurement of fast neutron energies. The energy resolution in such devices is usually markedly affected by the time spread due to the pulse height distribution of monoenergetic neutrons. It was found that by simple combination of the signals from the neutron detector and the time-to-pulse-height converter, the time resolution could be considerably improved. The originally 3 m μsec resolution time for 50 × 250 mm plastic phosphor scintillation detectors decreased in this way to 1.1 m μsec, while the efficiency for 14.7-Mev neutrons remained unchanged. (auth)

34255 ROENTGENOMETER WHICH DETERMINES THE QUALITY OF RADIATION. V. K. Lyapidevskii and R. S. Milshtein (Research Inst. for Roentgen-Radiology, Ministry of Health, USSR). Med. Radiol., 8: No. 5, 62-5 (May 1963). (In Russian)

A roentgenometer with two ionization chambers, which make it possible to determine the quality of radiation, is described. (auth)

34256 THE TECHNIQUE OF UTILIZING IFKB CASSETTES IN BETA-DOSIMETRY. M. S. Egorova. Med. Radiol., 8: No. 5, 70-4(May 1963). (In Russian)

A detailed description of the technique of determining the β coefficient involved in the calculation of dose from external beta radiation is given. It is shown that the β coefficient may vary greatly depending upon the maximal energy of beta radiation. A brief analysis of works on beta dosimetry is also given. (auth)

34257 IMPROVEMENT OF COUNTING EFFICIENCY IN LIQUID SCINTILLATION COUNTING BY USING FROSTED VIALS. Hideo Teshima. Radioisotopes (Tokyo), 12: 107-8(May 1963). (In Japanese)

34258 PULSE-HEIGHT ANALYZER FOR γ-RAY SPECTROMETER. Seturo Kinbara. Radioisotopes (Tokyo), 12: 170-81(May 1963). (In Japanese)

34259 THE SCINTILLATION COUNTER. ITS BASIC CHARACTERISTICS AND APPLICATION TO γ-RAY SPECTROMETRY. Takeshi Iinuma and Toshiyuki Hiramoto. Radioisotopes (Tokyo), 12: 182-99(May 1963). (In Japanese)

34260 RECENT DEVELOPMENTS IN DATA ANALYSIS TECHNIQUE FOR GAMMA SPECTROMETRY. Yoshihiko Tendow. Radioisotopes (Tokyo), 12: 200-5(May 1963). (In Japanese)

34261 TOTAL COUNTING EFFICIENCIES OF NaI (Tl) CRYSTAL. Masaharu Okano. Radioisotopes (Tokyo), 12: 253-7(May 1963). (In Japanese)

34262 PHOTOPEAK EFFICIENCIES OF NaI (Tl) CRYSTAL. Masaharu Okano. Radioisotopes (Tokyo), 12: 258-60(May 1963). (In Japanese)

34263 IMPROVED END WINDOW G.M. COUNTER USING AN INNER METAL DISK. Juichi Akutsu and Kiyoshi Kanno. Rika Gaku Kenkyusho Hokoku, 39: 1-4 (1963). (In Japanese)

34264 A CURRENT STABILIZER FOR MAGNETIC FIELD OF A HEAVY PARTICLE MAGNETIC SPECTROMETER. Sheau-Juang Hwang, Ming Chung, Gwo-yang Chung, and Yeou-kay Jin. Wu Li Hsueh Pao, 18: 540-3(Oct. 1962). (In Chinese)

34265 A LUMINESCENCE CHAMBER. O. Gildemeister (Universität, Bonn). Z. Physik, 174: 525-35(1963). (In German)

A luminescent chamber, consisting of a homogeneous CsI–Tl-scintillator and a four-stage magnetically focussed image intensifier was built. Using large aperture lenses for the imaging of the intensifier output screen to the photographic film, the light spot from a single photoelectron of the intensifier front-photocathode can easily be photographed. Intensification and resolution of the intensifier are about 10^6 and 0.1 mm respectively. The conditions for seeing tracks of minimum ionizing particles and the problems of spacial and time-resolution, of the depth of sharpness and the possibilities of stereo-viewing are discussed. Photographs of 400-Mev positron tracks are shown. The density of image spots in this case is 20 to 40 per cm track length. A comparison of the luminescent chamber with other track chambers is discussed. (auth)

34266 NEUTRON DOSIMETRY. VOL. I. Proceedings of the Symposium on Neutron Detection, Dosimetry and Standardization Held at Atomic Energy Research Establishment, Harwell, England, 10-14 December 1962. (International Atomic Energy Agency, Vienna). Proceedings Series. May 1963. 655p. (STI/PUB/69(Vol.I)). $13.00; 273s; NF 52; DM 45.50(IAEA).

Fifty-one papers are included; 40 are in English, 8 in French, and 4 in Russian. Separate abstracts have been prepared for 36. Fifteen papers were previously abstracted in NSA. (T.F.H.)

34267 RECENT DEVELOPMENTS IN FAST-REACTOR NEUTRON SPECTROMETRY TECHNIQUES: IONOGRAPHIC EMULSIONS, JUNCTIONS, FISSION CHAMBERS AND ACTIVATION MONITORS. J. L. Campan (CEN, Cadarache, France), P. Caumette, A. Desprets, A. Kania, C. Beets, P. Colle, H. Deckers, and Ghislaine Gierts. p.13-26 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

Methods are described for analyzing neutron spectra inside fast-neutron reactors and related experiments. For the direct measurements, (n,p) collisions and the $Li^6(n,t)He^4$ reactions are used. In the case of the (n,p) collision, type L Ilford emulsion is used, and the response of Gevaert 307 emulsion is determined. The evaluation of tracks is done entirely by photography. A semi-automatic microscope with direct reading at the eyepiece instead of on the stage is developed. As regards the indirect measurements, various improvements in the design of miniature fission chambers are referred to, and the results are given of a systematic study of a 4π β-particle counter that is mainly intended for detectors using phosphorus, sulfur, sodium bicarbonate, etc., in the form of a powder enclosed in small aluminum containers. Various methods of processing the results are reported. One application is selected as an example to illustrate the results obtained with the technique described. (auth)

34268 FAST NEUTRON MEASUREMENTS BY THRESHOLD DETECTORS IN ISPRA 1 (CP5-TYPE) AND AVOGADRO RS 1 (SWIMMING-POOL) REACTORS.

M. Bresesti, A. M. Del Turco, A. Ostidich, A. Rota, and G. Serge (Euratom, Ispra, Italy). p.27-50 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

Measurements are carried out by threshold detectors in a heavy-water (Ispra 1) and swimming-pool (Avogadro RS 1) reactor. Use is made of the following reactions: $Np^{237}(n,f)$; $U^{238}(n,f)$; $Th^{232}(n,f)$; $S^{32}(n,p)P^{32}$; $Ni^{58}(n,p)Co^{58}$; $Al^{27}(n,p)Mg^{27}$; $Fe^{56}(n,p)Mn^{56}$; and $Al^{27}(n,\alpha)Na^{24}$. From the activation data the distribution spectra of fast neutrons are calculated on an IBM 7090 computer by the use of different elaboration methods. (auth)

34269 NEUTRON SPECTROSCOPY AND DOSIMETRY AT THE MEDICAL-THERAPY FACILITY OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY REACTOR. G. L. Brownell, M. R. Raju, R. A. Rydin, and R. I. Schermer (Massachusetts General Hospital, Boston and Massachusetts Inst. of Tech., Cambridge). p.51-70 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

As part of a program for use of the medical-therapy facility of the MIT reactor for neutron-capture therapy, an intensive study of neutron spectroscopy and mixed neutron and gamma dosimetry at the facility is undertaken. The first portion of this study, the determination of the neutron spectra in the range from 0.02 to 0.2 ev, is accomplished by means of a crystal spectrometer. The results indicate that the neutrons emerging from the reactor port are well thermalized. Estimates of the fast-neutron flux are made by thermal flux distributions in a water phantom; they indicate a value of fast flux of about 2×10^8 n/cm^2 sec in contrast to the thermal flux of 2×10^{10} n/cm^2 sec. Studies are underway on two alternative methods of fast-neutron spectroscopy. The first is a modification of the threshold foil-detector method using computer programs to fit exponential decay curves and to obtain neutron spectra from the activation data. The second method employs solid-state detectors with Li^6 to measure directly the neutron spectra. The advantages and limitations of these methods are discussed. Gamma and neutron dose rates are measured with ionization chambers and high- and low-Z glass-rod photofluorescent dosimeters. The problem of separating gamma and neutron dose rates is complex in that most of the gamma rays originate from neutron capture in tissue or in the collimators. The contribution of core gamma rays to the total dose rate is small. A report of the measurements carried out during actual neutron-capture therapy is made. Further, results of preliminary calculations on the improvement of thermal-neutron distribution by use of incident epithermal neutrons is given. (auth)

34270 PROBLEMS PRESENTED BY THE USE OF ACTIVATION DETECTORS. A. Charbonnel (CEN, Saclay, France). p.71-9 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

The results are defined that are considered desirable to obtain in pile-neutron dosimetry. A knowledge of the goal that makes it possible to study the general problems presented by this type of measurement as well as the solutions that activation methods offer. For application of these methods it is necessary to construct detectors and to devise counting techniques. The materials and methods used in the Department of Large Experimental Reactors at Saclay for these two fields of activity are described. Taking semi-industrial application as a reference point, the difficulties encountered and the practical limitations of the methods in question are defined. (auth)

34271 METHODS OF MEASURING FLUXES AND DOSES OF NEUTRONS AND GAMMA RAYS, EVOLVED FROM IN-PILE EXPERIMENTS. Y. Droulers (CEN, Grenoble, France). p.81-8 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

The operating cycle of the Mélusine reactor and the nature of its experimental zones necessitate numerous spatial and temporal variations in the neutron flux and in the spectral distribution of neutrons. These variations and the problems connected with them are summarized. Ways are described by which nuclear measurements relating to the operation of the reactor and to dose measurements derived from in-pile experiments are adapted to the existing situation. Some of the approaches used are: the development of methods of making measurements at full reactor power; the frequent use of flux integrators for thermal and fast neutrons; a systematic study of the spectrum; and the development of calorimetric methods. (auth)

34272 THE CONTINUOUS MEASUREMENT OF HIGH-INTENSITY THERMAL-NEUTRON FLUX AND GAMMA FLUX AT HIGH TEMPERATURES. W. R. Loosemore, R. P. Henderson, and G. Knill (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.89-101 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

A mean-current ionization chamber is described for the measurement of thermal neutron flux up to 5×10^{13} n/cm^2 sec and gamma flux up to about 5×10^7 r/h at temperatures up to 500°C. Data are presented on the collection characteristics of a chamber having stainless-steel electrodes coated with uranium oxide enriched in U^{235} for current densities from 10^{-9}–10^{-4} A/cm^2. A brief account is given of the performance of mineral-insulated connecting cables at high temperature, and the importance of charge storage due to trapping effects in the dielectric is assessed for operation in a reactor. Results of extended reactor-life tests on chambers and cables are given for chambers with uncoated electrodes and for those coated with pure U^{235} and U^{238}/U^{235} mixtures. By a suitable choice of the U^{238}/U^{235} ratio, ionization from the fission of Pu^{239} produced by neutron absorption in U^{238} can be made to compensate for the burn-up of U^{235}, so that the current sensitivity remains constant for an extended irradiation period. The optimum ratio is a function of temperature and neutron energy spectrum; it is 16:1 in a graphite-moderated reactor at a temperature of 260°C. Experiments confirm that with such a mixture the current sensitivity of a chamber may be maintained constant within ± 4% over an integrated thermal-neutron flux of 4×10^{20} n/cm^2. The measured sensitivity of one chamber containing 6.5 mg of such a compensated coating is 4.1×10^{-17} A per n/cm^2 sec and at an output current of 600 μA the operating voltage is 400 v. (auth)

34273 MEASUREMENTS OF NEUTRONS IN SPACE. W. N. Hess (Goddard Space Flight Center, Greenbelt, Md.). p.103-10 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

Measurements of the neutron flux in space are made on several space vehicles. The neutrons observed in space near the earth are generated by cosmic rays entering the atmosphere and undergoing nuclear collisions with oxygen and nitrogen nuclei. About 20% of the neutrons made this way leak out of the atmosphere and are found in space. The electrons and protons made by neutron decay form most of the inner Van Allen radiation belt and may also produce an important part of the outer belt. The principal

problem associated with the measurement of the neutron flux in space is to avoid the background of (p,n) neutrons formed by protons striking the detector and the spacecraft. This can be done successfully by the use of a BF_3 counter, moderated by a scintillator, viewed by a photomultiplier and using anticoincidences to avoid counting the (p,n) events. Measurements are made of the neutron flux resulting from galactic cosmic rays (in n/cm^2 sec) and also from polar-cap proton-produced neutrons. (auth)

34274 A UNIFIED FORMULATION FOR THE SPECIFICATION OF NEUTRON FLUX SPECTRA IN REACTORS. Robert G. Nisle (Phillips Petroleum Co., Idaho Falls, Idaho). p.111-52 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

The essence of the integral method for measuring neutron flux parameters is an energy-averaged value of an energy-dependent cross section of the detector material. Various concepts and experimental techniques are developed to meet specific needs, but these lack unity and generality. Hence, a generalized and unified formulation for defining and measuring such parameters is presented. Unification is accomplished by the adoption of some existing concepts and the abandonment of the "cadmium ratio" concept in favor of one in which the neutron spectrum is divided into Maxwellian and non-Maxwellian components. The main features of the proposed formulation are that: it is based on integrated reaction rates; flux parameters are measurable by physically realizable detectors; it is applicable to any cross section function of energy; the reactor neutron flux spectrum is expressed in terms of Maxwellian and non-Maxwellian components; it forms the basis for a universal flux spectrum detector capable of measuring neutron temperature, equivalent 1/E component, and conventional flux with a single foil, or wire, by a single irradiation; and the resonance integral concept is generalized. (auth)

34275 A NEW METHOD OF USING GOLD FOILS FOR THE INVESTIGATION OF THE LEAKAGE SPECTRA FROM CRITICAL ASSEMBLIES. N. Adams and J. A. Dennis (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.173-80 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

Two thick gold foils, sandwiching a cadmium foil, are subjected to irradiation. Subsequent measurements of the beta radiation from both sides of the gold foils yield estimates of the thermal- and epithermal-neutron fluxes in the neighborhood of a critical assembly. (auth)

34276 STUDY OF THE n,γ REACTION CROSS-SECTION FOR GOLD: CALCULATION OF THE ACTIVITY OF A THICK GOLD DETECTOR. J. J. Brisbois (CEN, Fontenay-aux-Roses, France). p.181-93 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

The resonance integral for gold and its variation as a function of the coefficient α (which follows the law $1/E^{\alpha}$) are calculated from the Breit-Wigner formula. The activity of detectors of different thicknesses is then calculated and the theoretical results compared with those obtained experimentally. (auth)

34277 INTERPRETATION OF ACTIVATION MEASUREMENTS. Ugo Farinelli (CNEN, Ispra, Italy). p.195-210 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

The influence of the detailed shape of the neutron spectrum on activation measurement in the thermal and epithermal region is studied. Machine calculations are performed and reported, covering a wide range of cases, for Cd and Gd ratios of 1/v detectors (plus resonances above 1 ev) and for detectors having a non-1/v behavior in the thermal of joining region, as a function of thickness of shield, geometry of irradiation, neutron temperature, epithermal content, and shape of the joining function. The measurement of neutron temperatures by means of Lu is also considered. (auth)

34278 MEASUREMENT OF INTEGRATED THERMAL-NEUTRON DOSES BY THE SOURCE-DEPLETION METHOD. Ugo Farinelli (CNEN, Ispra, Italy). P.211-14 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

A method for measurement of integrated neutron fluxes is proposed. It consists of irradiating, together with the experiment that it is desired to monitor, one of two radioactive sources of the same isotope, the ratio of whose activities is previously determined to be r. If the ratio of the activities after irradiation is found to be r', the integrated flux is given by an integral equation. For good sensitivity, σ^{-1} (capture cross section)$^{-1}$ should be of the same order of magnitude as the integrated flux to be measured. No new radioactive nucleus should be produced in the irradiation, so that only carrier-free sources are studied. Very few neutron cross sections for radioactive nuclei are known, so some of them are measured by the source-depletion method. Results concerning Na^{22} and Co^{58} are reported. The Co activation method is used for monitoring of the flux. (auth)

34279 OSCILLATION AND ACTIVATION MEASUREMENTS OF RESONANCE INTEGRALS AND EPITHERMAL-NEUTRON SPECTRA WITH THE ISPRA-2 REACTOR. Ugo Farinelli (CNEN, Ispra, Italy). p.217-25 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

Several techniques, including oscillation, activation, and reactivity measurements, are used in the Ispra-2 reactor for the study of effective resonance integrals and epithermal-neutron spectra in a light-water lattice. Measurements are carried on on various nuclei (in solutions) and in different neutron spectra. The purpose of these measurements is to get data on nuclei (both stable and radioactive); and to study the influence of the model used for the neutron flux, to see the energy dependence of the adjoint flux (by comparison between oscillation and activation measurements), and to check calculations both of the neutron spectra (obtained by multigroup, few-region codes) and of the self-shielding factors in the case of concentrated solutions. (auth)

34280 MEASUREMENT OF THE THERMAL- AND EPITHERMAL-NEUTRON FLUX IN THE REACTOR DR 1. B. Fastrup and J. Olsen (Atomic Energy Research Establishment, Risø, Roskilde, Denmark). p.227-45 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

The thermal and the epithermal parts of the neutron spectrum in the Westcott flux notation are calculated from the activities of foils irradiated bare and cadmium-covered. Detectors of gold, manganese, cobalt, and indium are irradiated in the center of the water-boiler DR 1. In addition a semi-differential method is presented from which can be determined the shape of the epithermal neutron spectrum from activation measurements. (auth)

34281 AN INVESTIGATION OF THE INTERMEDIATE-ENERGY NEUTRON DOSE AROUND NUCLEAR INSTAL-

LATIONS. J. W. Smith (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.261-8 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

The relative importance of the intermediate-neutron hazard in the neighborhood of nuclear reactors, neutron generating machines, and neutron sources is investigated with the Basson intermediate-energy neutron detector. Results are compared with measurements made with a cadmium-covered BF_3 counter, boron-shielded fission chambers, and standard neutron and gamma radiation detectors. (auth)

34282 THE LONG-TUBE METHOD FOR THE MEASUREMENT OF NEUTRON FLUXES INSIDE REACTORS. V. Ajdačić and B. Lalović (Boris Kidrič Inst. of Nuclear Sciences, Belgrade). p.271-6 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

A method for the measurement of very high neutron fluxes inside reactors operating in the megawatt region is described. Semiconductor detectors observe heavy particles coming from neutron-induced reactions in the core through a long, evacuated aluminum tube. Low-Z targets as well as fissile isotopes are used. The possibilities of absolute neutron flux measurements and neutron spectroscopy work in operating reactors are discussed. (auth)

34283 DOSIMETRY AND SPECTRAL DISTRIBUTION OF A FAST-NEUTRON FLUX FOR USE IN BIOLOGICAL EXPERIMENTS. Y. Arnaud (CEA, Paris). p.277-91 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

The El3 reactor has a chamber for the irradiation of biological material, equipped with a uranium converter. This apparatus produces a flux of fission neutrons. Gamma irradiation and thermal neutrons are strongly absorbed by lead and boral screens. The radiations and their spectral distribution are measured at various points of the irradiation chamber to show the heterogeneity of the doses in the volume irradiated and the anisotropy of the fast and intermediate fluxes. For the purpose of the biological experiments in question, it is convenient to have this information available during the actual process and to record it directly. To achieve this, three types of detectors are used, each of which is more or less specifically suited to the various radiations to be measured in this mixed radiation field. For measurement of the fast flux, a cluster assembly of four miniature fission chambers is used; this can easily be moved about within the chamber and also inside the experimental animals. A cadmium U^{235} chamber gives the total flux of fission neutrons; the Np^{237} chamber, the neutrons with energies of above 0.7 Mev; the Am^{241} chamber, energies above 1.1 Mev; and there is a Th^{232} chamber for neutrons above 1.8 Mev. These detectors, of known efficiency, permit an approximation to be made of the spectrum distribution of neutrons by a step function which is clearly indicated by the cross section pattern of the metals. The very weak thermal flux is measured by a gamma-compensated boron ionization chamber, and checked by the U^{235} chamber with and without cadmium. Lastly, provision is made for the residual gamma radiation in this mixed field by means of a calibrated ionization chamber. All the above information is collected on an 8-channel recorder (two channels are reserved for biological parameters). The data furnished by this apparatus tally with information obtained with other techniques. The method thus provides a rapid and flexible means of carrying out dosimetry work in radiobiology. (auth)

34284 SPECTRUM ANALYSIS OF FAST NEUTRONS BY MEANS OF THE $Li^6(n,t)He^4$ REACTION. C. Beets and M. Lott (Euratom, Brussels). p.293-305 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

The possibilities of the $Li^6(n,t)He^4$ reaction in the spectrum analysis of fast neutrons, the techniques used, and the results obtained are described. The techniques make use of fine-grain and superfine-grain emulsions charged with lithium, and junctions (solid-state ionization chambers); the characteristics reached by the junctions made in the laboratories are specified. Two cases are considered in the application of spectrometry. In the first, the neutron energy is deduced from the law of conservation of energy; in the second, the neutron spectrum is deduced from the triton spectrum, the irradiation geometry being known. (auth)

34285 THE USE OF RECOIL-PROTON METHODS FOR MEASURING NEUTRON SPECTRA IN A FAST REACTOR. P. W. Benjamin (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.307-18 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

The neutron spectra in the core and blanket of the zero-energy fast reactor VERA are deduced from the recoil-proton spectra in hydrogenous detectors. For accurate measurements above 400 kev the photographic emulsion technique is used. A semi-automatic plate-scanning system permits an accurate spectrum (5000 tracks) to be obtained by one person in 50 h. Rapid measurements of spectra above 1 Mev in low neutron fluxes are made with an organic scintillator using pulse-shape selection to discriminate against γ-ray pulses. This yields quick results, but its accuracy is limited by double scattering of neutrons. A method of extending the recoil-proton technique down to energies of 20 kev by the use of a hydrogen-filled proportional counter is being developed. The three techniques are briefly described, and results obtained with them are compared with calculations. (auth)

34286 IN-PILE FAST-NEUTRON SPECTRUM MEASUREMENTS BY THRESHOLD DETECTORS. R. Dierckx (Euratom CCR, Ispra, Italy). p.325-35 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

The shape of the fast flux spectrum above 0.5 Mev in reactors can be measured by threshold detectors. In defined energy intervals an exponential approximation of the spectrum is valuable together with a linearization of the cross section. This permits one to solve the activation integrals of the detectors. Two spectra are measured and compared with spectra measured by nuclear emulsion techniques. (auth)

34287 EXPERIMENTAL FAST-NEUTRON SPECTRA IN ALUMINIUM AND IRON. G. During, R. Jansson, and N. Starfelt (Forsvarets Fursknings anstalt, Stockholm). p.359-67 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

Few measurements of fast-neutron spectra in reactor shields and other types of shield have been published. This is mainly because of the great experimental difficulties involved in such measurements. Most information concerning fast-neutron spectra in shields has been obtained from calculations performed by means of the moments method or by Monte Carlo techniques. It is of considerable interest to check these calculations with reliable experiments. The organic scintillator, employing pulse-shape discrimination to eliminate γ-ray background, presents a possibility of measuring neutron spectra above energies of about

0.5 Mev with an accuracy of the order of 10%. In the present investigation monoenergetic neutrons of energies 3 and 15 Mev were obtained from an electrostatic accelerator through the $D(d,n)He^3$ and $T(d,n)He^4$ reactions. The spectrum of the fast neutrons produced by these neutron sources in and behind shields of different thicknesses was studied by means of a stilbene spectrometer. Iron shields of thicknesses from 5 to 40 cm and aluminum shields of 40-cm thickness were investigated. For the purpose of obtaining an estimate of the neutron spectrum below 0.5 Mev, measurements with a Li^6I scintillator surrounded by plastic spheres of different diameters were also performed. The experimental results are compared with Monte Carlo calculations. (auth)

34288 THE USE OF MAGNESIUM, TITANIUM, IRON, NICKEL AND ZINC IN FAST-NEUTRON ACTIVATION DOSIMETRY. W. G. Cross (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.389-98 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

Among activation reactions used for the measurement of neutrons with energies above 2 Mev, and whose products have a half life greater than one day, the widely used $S^{32}(n,p)P^{32}$ reaction is the most sensitive, provided that the P^{32} is separated from the sulfur. Other reactions, although less sensitive, are valuable under certain circumstances. The properties of some of these reactions are surveyed, and the conditions under which they may be particularly useful are discussed. All the activities considered were measured by their gamma emission, so that relatively large samples could be counted without prior separation of the reaction products. When knowledge of the fast-neutron energy spectrum is very limited, the dose estimated from any single activation detector may be in error by as much as a factor of two. The error can be reduced considerably by the simultaneous use of several reactions with different thresholds. The use of groups of three such reactions is discussed, and the errors in the estimated dose are calculated for various neutron spectra. For determination of doses in short experimental exposures, the np reactions of Fe^{56}, Zn^{64}, and Mg^{24} are used. For dosimeters worn by personnel rarely exposed to fast neutrons, it is desirable to have an induced activity with a longer half life than that of P^{32} to reduce the frequency with which dosimeters must be measured. For this purpose the $Ni^{58}(n,p)Co^{58}$ reaction appears to be the most suitable. It is sensitive enough to detect an average dose of 50 mrad/wk at the end of an 8-wk period. At neutron energies above 12 Mev, the $Ni^{58}(n,np)Co^{57}$ reaction will detect a smaller average dose at the end of six months. The $Ti^{46}(n,p)Sc^{46}$ reaction provides additional information on the neutron spectrum, but with lower sensitivity. Some of these cross sections have not yet been measured at all energies of interest. The problems of distinguishing the desired activities from those produced by other reactions in the detectors have been studied. (auth)

34289 REMARKS ON THE USE OF THRESHOLD DETECTORS. A. H. W. Aten, Jr., G. A. Brinkman, I. Heertje, and W. Nagel (Instituut Voor Kernphysisch Onderzoek, Amsterdam). p.399-408 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

For many purposes the use of threshold detectors still represents the most convenient technique for the measurement of fast-neutron fluxes. The use of this type of detector requires both a convenient method for measuring the total activity in the sample and sufficiently accurate information concerning the cross section as a function of energy. In several cases the measurement of the radionuclide produced in the detector can be based on β-γ coincidence measurements by means of a combination of special scintillators. (The same technique is found useful for the calibration of thermal-neutron detectors.) There are, however, some detectors for which this method is not suitable. On the other hand, it can be used even as a basis for the measurement of pure β-emitters. The evaluation of the flux measurements is based primarily on the determination of the cross section as a function of the neutron energy. However, a useful check on these measurements can be obtained by means of activation measurements in a known neutron flux with a known energy spectrum. In some cases such a flux can be obtained conveniently from a radioactive neutron source, e.g., a Ra-α-Be source, but occasionally another type of neutron generator, e.g., a cyclotron, is to be preferred. (auth)

34290 MEASUREMENT OF FAST-NEUTRON SPECTRAL DISTRIBUTIONS BY MEANS OF A SEMICONDUCTOR DETECTOR. K. H. Kim (Österreichische Studiengesellschaft für Atomenergie, GmbH, Vienna). p.417-23 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

In a preliminary experiment a tiny semiconductor detector of n-p junction type, with a sensitive area of 5 mm^2, is combined with a thin paraffin layer at a certain distance from it to provide a small fast-neutron spectrometer. The thickness of the paraffin layer is chosen so as to avoid appreciable absorption of recoil protons and at the same time to have a sufficient detector efficiency. Between the detector and the paraffin layer a proton collimator is inserted to remove the ambiguity due to the recoil angle. If a neutron source has a low intensity, measurements can be carried out only without a collimator because of the low overall detection efficiency, and analysis of the registered pulse-height distributions is duly required. For avoidance of fast-neutron scattering, measurements are carried out in a free geometry. Because of the large source-to-detector distance the proton collimator selects only protons from head-on collisions. To take the background into account, measurements are carried out with and without the paraffin layer. Pulses coming from the semiconductor detector are registered on a multichannel analyzer. The possibilities of using a detector based on this principle for measurements under high-background conditions in a reactor beam hole are discussed. (auth)

34291 FAST-NEUTRON SPECTROMETRY BY MEANS OF SCINTILLATION MONOCRYSTALS OF LITHIUM IODIDE. V. V. Matveev, B. P. Panova, T. F. Rasskazikhina, and A. D. Sokolov. p.455-9 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In Russian)

The authors examine questions concerning the use of monocrystals of lithium iodide, activated by europium, for the spectrometry of a fast-neutron flux with a comparatively intense gamma background. A technique is described for the measurement of the spectra with the aid of two crystals possessing equal sensitivity to gamma radiation but of markedly different performance in recording fast neutrons. The results of several measurements obtained by means of these spectrometers are also described. (auth)

34292 REACTOR NEUTRON SPECTRUM DETERMINATION AND ITS INFLUENCE ON PRIMARY KNOCK-ON ATOM SPECTRA IN FINITE TEST SPECIMENS. J. Moteff and J. R. Beeler, Jr. (General Electric Co., Cincinnati).

p.461-79 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

For prediction of the effects of neutron irradiation on the properties of materials the number of atom displacements is one of the principal parameters which must be determined. Knowledge of the angular distribution and the energy spectrum of the neutrons which are incident on the test specimen must also be known. Studies on the intensity and spectrum of the primary knock-on atoms in metals for various conditions of neutron spectra and specimen geometry are being made. The neutron spectrum, representative of the conditions in which over 300 stress-rupture and tensile test specimens were irradiated, was calculated with the use of a multigroup, multiregion computer neutron-diffusion program. An evaluation of this theoretical spectrum was made by comparison of the specific activities of threshold and resonance detectors, calculated from available differential cross sections and the theoretical neutron spectrum with the measured specific activities of the same detectors which were irradiated in the specimen test capsule. The technique of using the test specimen itself as the neutron dosimeter has also been demonstrated to yield consistent data. Some of the neutron reactions used to obtain information on the reactor spectrum are $Ni^{58}(n,p)Co^{58}$, $Fe^{54}(n,p)Mn^{54}$, $Ti^{46}(n,p)Sc^{46}$, $Cr^{50}(n,\gamma)Cr^{51}$, $Fe^{58}(n,\gamma)Fe^{59}$, and $Co^{59}(n,\gamma)Co^{60}$. A correction for the burn-up of $Co^{58m}(n,\gamma)Co^{59}$ was considered in the calculation of the Co^{58} yield. The studies on the spectrum and the number of primary knock-on atoms in pure iron and in a binary 92Ni–8Al alloy are based on calculations using a Monte Carlo IBM computer program. This program accounts for anisotropic neutron scattering in the center-of-mass system, the finite size of the sample, and neutron slowing-down in the sample. (auth)

34293 MEASUREMENT OF FAST-NEUTRON SPECTRA BY MEANS OF NUCLEAR EMULSIONS. S. Passe (CEN, Fontenay-Aux-Roses, France). p.481-99 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

The spectra of fast neutrons of between 0.5 and 15 Mev were measured in heavy-water, light-water, and graphite reactors and also in various shielding experiments. The method is as follows: protons are projected into a nuclear emulsion by parallel-beam neutrons, and the energy of the protons emitted is measured within a narrow solid angle whose axis lies along the direction of incidence of the neutrons. (auth)

34294 THE USE OF NICKEL-58 AND IRON-54 AS INTEGRATORS OF FAST-NEUTRON FLUX. T. O. Passell (Stanford Research Inst., Menlo Park, Calif.). p.501-13 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

The (n,p) reactions on nickel (Ni^{58}) and iron (Fe^{54}) are widely used for the integration of fast-neutron fluxes in reactor environments. Among the reasons for these choices are (1) their large cross sections (101 mb and 60 mb, respectively) for fission spectrum neutrons, (2) the long half lives of the cobalt (Co^{58}) and manganese (Mn^{54}) reaction products (71.3 d and 314 d, respectively), (3) the convenient physical and chemical properties of nickel and iron, and (4) the freedom from interference by other nuclides produced by neutrons (the only serious one is Fe^{59} from $Fe^{58}(n,\gamma)$. A fundamental limitation of Ni^{58} arises from the large thermal-neutron cross sections of Co^{58} and Co^{58m} (1650 and 140,000 b, respectively). The thermal-neutron burn-up of Co^{58} and Co^{58m} becomes equal to the radioactive decay rate at a thermal flux (n/cm^2 sec) of 6.7×10^{13} for Co^{58} and 1.5×10^{14} for Co^{58m}. Thus at thermal fluxes around 10^{14} nickel can integrate fast-neutron flux over irradiations only half as long as at thermal fluxes below 10^{12}. The difficulty of Ni^{58} with Co^{58} burn-up plus the longer life of Mn^{54} have led to greater use of Fe^{54}. Measurements at the National Reactor Testing Station show that the Mn^{54} thermal-neutron cross section is less than 30 b, and therefore thermal-neutron burn-up is not significant. The interference of Fe^{59} may be eliminated by a post-irradiation cooling period much longer than the 45-d half-life of the species, by chemical separation of Mn^{54} from the iron, or by the use of iron depleted in Fe^{58}. Unfortunately, the cross section versus energy for $Fe^{54}(n,p)$ has not been as thoroughly measured as it has for $Ni^{58}(n,p)$. From the few cross-section measurements made so far the $Fe^{54}(n,p)$ effective threshold appears to be about the same as for $Ni^{58}(n,p)$, i.e., 3 Mev. Most radiation effects are caused by neutrons of lower energy. However, once the energy spectrum in a given environment has been obtained by sophisticated means, Fe^{54} and Ni^{58} serve as useful routine monitors. (auth)

34295 A MONITORING TECHNIQUE FOR RADIATION DAMAGE EXPERIMENTS. A. D. Rossin (Argonne National Lab., Ill.). p.515-19 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

The reaction $Fe^{54}(n,p)Mn^{54}$ was used as a monitor for radiation-damage experiments. Activity of Mn^{54} in irradiated steel is directly proportional to the exposure of the samples. All samples were exposed in the same location, which eliminates the question of spectrum influence. Four gamma-ray spectra taken from irradiated steel are shown. (auth)

34296 FAST-NEUTRON MEASUREMENTS IN CIVIL POWER REACTORS. L. K. Burton and A. E. Souch (Central Electricity Generating Board, London). p.521-33 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

Fast-neutron spectral measurements in civil reactors are made primarily to provide data for the study of radiation-damage processes in reactor materials. A secondary reason for such measurements is to provide additional information for use in shielding studies. The particular problems of making such measurements are discussed, and criteria are derived which lead to the choice of suitable methods. The first method employed was that of measuring proton-recoil tracks arising from neutron-proton scattering in nuclear emulsions. An experiment at Bradwell Generating Station is described with special reference to the conditions of ambient temperature and gamma-radiation. The selection of detectors for a lower energy range than that covered by nuclear emulsions is described. (auth)

34297 VARIATION OF A FISSION-NEUTRON FLUX AND SPECTRUM FROM A FAST REACTOR MEASURED OVER LARGE DISTANCES. Lloyd D. Stephens and Henry Aceto, Jr. (Univ. of California, Berkeley). p.535-45 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (UCRL-10361). (In English)

Variations over large distances in the numerical flux density, the energy flux density, and the spectrum from a point source of fission neutrons were determined experimentally. Experimental work was carried on at the Nevada Test Site with the Oak Ridge National Laboratory Health Physics Research Reactor as the source of neutrons. The reactor height could be varied between 27 and 1500 ft (8 and 457 m), and the horizontal measurements extended from 250 to 1500 yd (228 to 1371 m) from the tower base.

The reactor was operated at power levels from 1 to 1250 W. Numerical flux densities were measured by the use of BF_3-filled proportional counters surrounded by various thicknesses of paraffin. Each detector therefore has its peak sensitivity in a different energy region of the given spectrum. Numerical flux densities were also measured by indium-foil activation. The foils were exposed in right circular cylinders of cadmium filled with paraffin. Energy flux density was measured by the use of a polyethylene-lined proton-recoil proportional counter. If the ratio between the latter detector and a BF_3 detector is taken, a measure of the average neutron energy is thus obtained. Nuclear emulsions were exposed to the reactor neutron flux at several locations. From an analysis of the proton-recoil tracks the neutron spectrum can be inferred. Results of this study provide much information on the variation of the neutron flux and spectrum as measured over large distances from a source. An analysis of the data also reveals the contribution to the total measured flux due to scattered neutrons as well as the relaxation length of the given spectrum. (auth)

34298 THERMAL FLUX PERTURBATION BY COBALT DETECTORS. A. Spernol, R. Vaninbroukx, and G. Grosse (Euratom, Brussels). p.547-52 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

Precise measurements on Co foils that will be used in the EURATOM-norm are reported. Separate values for the self-shielding inside and flux depression outside the foil are given, and comparison with theory is made. (auth)

34299 ON THE USE OF TITANIUM AS A THRESHOLD DETECTOR FOR FAST-NEUTRON FLUX MEASUREMENTS. W. L. Zijp (Reactor Centrum Nederland, Petten, Netherlands). p.589-95 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

For the measurement of the time integral of the fast-neutron flux in research reactors the threshold reaction $Ni^{58}(n,p)Co^{58}$ is widely used. However, this method has the disadvantage that the nuclides Co^{58} and Co^{58m}, which are produced in this reaction, have very large cross sections for absorption of thermal neutrons (about 1650 and 170,000 b, respectively). With a view to avoiding the burn-up difficulties of the nickel method, a study was made on the use of the reaction $Ti^{46}(n,p)Sc^{46}$ for measuring the integrated fast-neutron flux. At this moment the cross section data for titanium are not sufficiently known. In an experimental investigation some irradiations of aluminum, nickel, and titanium foils at the same positions have been performed in the H.F.R. and in the L.F.R. at Petten. The results of the experiments lead to the conclusion that the threshold reaction with titanium is very promising for the detection and measurement of fast neutrons. (auth)

34300 SiC NEUTRON DETECTORS FOR HIGH-TEMPERATURE OPERATION. R. V. Babcock and H. C. Chang (Westinghouse Electric Corp., Pittsburgh). p.613-22 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

The possibility of detecting charged particles with solid-state p-n junctions, first discovered by McKay, has been exploited in the detection of slow and fast neutrons. In recent years, Si and Ge p-n junction radiation detectors have found increasing application to the measurements of nuclear charged particles and neutrons. However, the use of these junctions is intrinsically limited to low temperature (< 150°C) and low radiation flux environments. We have now developed SiC p-n junction particle detectors which operate satisfactorily at temperatures exceeding 700°C and are expected to exceed greatly the resistance to radiation damage of present semiconductor particle detectors. Several techniques for preparing detectors have been investigated and the characteristics of the detectors evaluated. The techniques of preparation and their correlation with counting characteristics will be discussed elsewhere. Counting characteristics have been studied by the observation of the response of these "shallow" junction diodes to monoenergetic alpha particles. Neutron detectors are made by the application of a thin layer of an appropriate isotope, usually U^{235}, to the diode surface. When charged particles decelerate in the diode material, their kinetic energy is expended in forming electron-hole pairs, which are separated by the internal field of the junction to form a signal pulse. The mechanism of carrier collection is not yet completely analyzed. The efficiency of carrier collection appears to depend strongly on the junction width and potential gradients. In one type of diode the efficiency for collecting electron-hole pairs was found to increase with increase in either the applied bias voltage or the temperature. At temperatures exceeding 400°C the collection efficiency appeared to be nearly 100% with no applied bias. The high-frequency shot noise generated by the diodes increases continuously with temperature. At 800°C the shot noise is about equal in amplitude to the signals from 5-Mev alpha particles. Counting characteristics for 5-Mev alpha particles are discussed. Fission fragments, which have similar ranges and larger energies, are yet to be studied. Some initial observations of the rate of radiation damage to the counting characteristics are also presented. (auth)

34301 A NEUTRON DETECTOR FOR IN-CORE POWER MONITORING TO 1800°F. R. A. DuBridge (General Electric Co., San Jose, Calif.). p.623-30 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

A thermocouple-type detector has been designed, fabricated, and bench-tested for in-core power monitoring to temperatures of 1800°F and can probably be extended to higher temperatures. The detector is constructed as follows: First, a high-temperature metal (e.g., zirconium) is alloyed with uranium and drawn into wire. This wire is inserted in the center hole of a metallic center-piece, and a thermocouple is spot-welded to the center-piece for measurement of its temperature. Two spacers separate the center-piece from the cable and the bottom-end plug so that heat is transferred almost entirely in the radial direction. The assembly is then welded together, evacuated and baked out at 1800°F, backfilled with the appropriate gas and welded shut. The entire assembly is $\frac{1}{4}$ in. in diameter. The temperature difference between a uranium- and a non-uranium-containing assembly is given by the equation:

$$\Delta T = \frac{Q_{fission}}{2\pi L}\left[\frac{1}{2K_U} + \frac{\log(X_{2C}/X_{1C})}{K_C} + \frac{1/h_C + 1/h_F}{r_C}\right].$$

If 304 stainless steel is chosen, K_C is almost constant with respect to temperature and integrated neutron exposure. The detectors must be placed in environments where h_F and h_C are constant, contribute a negligible amount to ΔT or contribute the same proportion of the temperature drop to ΔT. By choice of alumel versus chromel thermocouple, the emf difference between the uranium- and non-uranium-containing assemblies is proportional to ΔT and almost constant with respect to integrated neutron exposure. The drift rate of thermocouple elements at 1800°F will be less than the U^{235} burnup rate. (auth)

34302 SOME RECENT DEVELOPMENTS IN HIGH-TEMPERATURE NEUTRON DETECTORS. A. Goodings and D. L. Roberts (Atomic Energy Establishment, Winfrith, Dorset, Eng.). p.631-52 of "Neutron Dosimetry. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In English)

New fission chambers have been added to the available range of devices capable of functioning in environmental temperatures up to 600°C. Confined-volume counters with external diameters of $\frac{1}{8}$ in., $\frac{1}{4}$ in., and $\frac{3}{4}$ in. are described, the last being equipped with a pulse transformer and flexible mineral-insulated leads. Two d-c fission chambers are being developed for neutron measurement in high fluxes. One of these, $\frac{1}{4}$ in. in diameter, is guardringed and designed to have a particularly wide working range. The low-noise matched-input head amplifier is discussed and its implications on chamber design noted. A general test specification for pulse fission counters is introduced. (auth)

34303 PRFR GAMMA ION CHAMBER (Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE-783)

This package contains 1 drawing. An electrometer head is used with a general purpose gamma ionization chamber for operating over a wide range of gamma intensity (1 mr to 1000 r). The chamber is pressurized at 10 atm with dry nitrogen gas. The electrometer head is used when the distance between the chamber and the electronics is great. With housing modifications, the electrometer head may be used with any gamma ionization chamber. The head is a $7\frac{1}{2}$ in. long, 2 in. OD cylinder of $\frac{1}{16}$ in. thick stainless steel. This cylinder connects with a 6 in. long stainless-steel cylinder 2 in. in dia which, in turn, connects with a much smaller dia (0.875 in. OD) stainless-steel cylinder. (F.E.S.)

34304 GAMMA SCINTILLATION DETECTOR CAN (Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE-784)

This package contains 1 drawing. The can is used as a gamma spectrometer detector. The crystal can body is $3\frac{15}{64}$ in. OD and 3.156 in. ID, composed of aluminum tubing $3\frac{11}{16}$ in. long. The NaI crystal that is used is 3 in. in dia and 3 in. long. This can is fitted to an evacuated copper tube which contains a photomultiplier tube. (F.E.S.)

34305 REGULATED HIGH VOLTAGE POWER SUPPLY (600 V–1800 V) (Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE-786)

This package contains 7 drawings. The power supply is used specifically for a scintillation detector, is variable in course steps of 85 v, and in fine steps of $5\frac{1}{2}$ v. It requires current of 0 to 1 ma and has a line regulation of 0.0003% per line voltage of 95 to 125 v. The regulation is achieved with series strain by means of an $85A_2$ regulation tube and a Zener diode. The ripple is 200 mv or less. (F.E.S.)

34306 MONTE CARLO CALCULATION OF THE ENERGY RESPONSE OF THE NARF HURST-TYPE FAST-NEUTRON DOSIMETER. T. W. De Vries (General Dynamics, Fort Worth, Tex.). 17p. (CONF-39-20; FZM-2944)

From American Nuclear Society Meeting, Salt Lake City, June 1963.

The response function for the fast-neutron dosimeter was calculated by the Monte Carlo technique (Code K-52) and compared with a calculation based on the Bragg-Gray principle. The energy deposition spectra so obtained show that the response spectra become softer with increased incident neutron energy above 3 Mev. The K-52 calculated total response is more nearly constant with energy than the Bragg-Gray response. The former increases 70 percent from 1 Mev to 14 Mev while the latter increases 135 percent over this energy range. (auth)

34307 DEVICE CONTAINING A FLUORESCENT MATERIAL FOR DETECTING AND MEASURING ENERGETIC RADIATION. R. Blank, H. Gold, K. L. Huppert, R. Metejec, R. Raue, and O. Dann (to Agfa Aktienges). German Patent 1,147,328. Apr. 18, 1963. Filed Oct. 14, 1961.

The device described consists of a fluorescent material and means for detecting the fluorescent radiation emitted when the fluorescent material is subjected to bombardment by ionizing radiation. When using photographic films for detecting the fluorescent radiation the fluorescent material is either applied in the form of amplification foils or is added to the photographic emulsion directly. The fluorescent materials are coumarin derivatives, benzothiophenedioxide and its derivatives, dibenzothiophenedioxide or its substituion products, 1,3-diphenylpyrazoline or its derivatives, and mixtures of the said materials. The formulas of a variety of fluorescent materials are given. (Gmelin Inst.)

34308 DEVICE AND METHOD FOR DETERMINING THE RADIOACTIVITY OF GAS-SOLS. J. H. Spaas (to Philips' Gloeilampenfabrieken). German Patent 1,148,336. May 9, 1963. Priority date Sept. 2, 1958, Netherlands.

A device for determining the radioactivity of gas-sols is described, which comprises means for detecting alpha rays and beta rays. Between the radioactive gas-sol and the detectors there are absorbers through which the rays pass before entering one of the detectors. The absorbers are calibrated so that the relation of detected beta to alpha rays for the daughter products of radon is equal to that for the daughter products of thoron. A detailed description of the device is given. (Gmelin Inst.)

ISOTOPE SEPARATION

34309 (K-1580) APPLICATION OF A SYSTEM OF BOLTZMANN EQUATIONS TO THE SEPARATION OF A BINARY GAS MIXTURE. [PART] II. Hanan Rubin (TRG, Inc., New York). Aug. 27, 1963. For Oak Ridge Gaseous Diffusion Plant, Tenn. Contract W-7405-eng-26. 24p.

The separation of a binary gas mixture by diffusion through a porous barrier is studied theoretically. The structure of the barrier is averaged out, and a system of Boltzmann equations is approximated by H. Grad's method of moments. Viscosity effects are included, and the results obtained are similar to those of Present and de Bethune for a capillary. A precise comparison with their results is given. (auth)

34310 (AEC-tr-5926) SEPARATION OF ISOTOPES BY IONIC MIGRATION. A. Klemm. Translated for Ames Lab., Ames, Iowa from Physikertag. Wiesbaden. Hauptvortraege Jahrestag. Verbandes Deut. Physik. Ges., [20] Wiesbaden, 3: 73-88, 1955 (Pub. 1956). 19p.

The history, principles, special experimental apparatus, theory, results of mass-effect measurements, and performance of electromigration separation processes are related. It is shown that separation processes depending on isotope transfer make possible an isotopic enrichment more easily than with other published separation processes. The experimental results serve to extend the conception of self-transference from solid bodies to liquids. (N.W.R.)

34311 SEPARATION OF THE OXYGEN ISOTOPES BY THE THERMAL DIFFUSION METHOD. E. P. Ageev and G. M. Panchenkov. At. Energ. (USSR), 14: 494-6 (May 1963). (In Russian)

A thermal diffusion cascade, consisting of three, 12-mm diameter columns, with a 0.4-mm diameter high-temperature resistant stainless steel wire, was used for separating the O isotopes. The gas was circulated through the columns from the 15-liter capacity container by a thermal siphon. The maximum separation coefficient of the system, S_{max} was found to be 8.45. As it was known that for fast and economical separation, several methods must be used conjointly, a highly productive and a very efficient system were combined for relatively large amounts of O^{18}: heavy-oxygen water, prepared by rectification and containing 40 weight % of H_2O^{18} was electrolyzed, sending the O through the thermal diffusion cascade. The separation was carried out at 640 mm of Hg pressure at a wire temperature of 1103°K. After 2 weeks of operation when the O^{18} concentration of the output reached 94%, the enriched product was separated; after 4 months of continuous operation more than 2 liters of O with an O^{18} content from 85 to 90 at. % were obtained. Comparison with other separation methods showed that the combined system is the best for preparing large amounts of the highly enriched product. (TTT)

34312 HEAVY WATER AS A BY-PRODUCT OF LIQUID HYDROGEN PRODUCTION. P. C. Vander Arend. Chem. Eng. Progr., 59: No. 8, 65-8(Aug. 1963).

A low temperature distillation process by which hydrogen deuteride may be separated from hydrogen, concentrated, and changed into deuterium is presented. The most important component of the system is the primary column in which hydrogen deuteride is concentrated to a mixture of 5 to 10% of hydrogen deuteride in hydrogen. The operation and method of incorporation of this column in a liquid hydrogen plant are discussed. This process reduces the operating costs for deuterium production to nine dollars per pound. (C.E.S.)

34313 ISOTOPE SEPARATION IN VISCOUS FLOW OF MOLTEN LITHIUM. A. Klemm (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 18a: 775-6(June 1963). (In German)

Experiments were carried out to determine if it is possible to change the ratio of lithium isotopes by forcing the molten metal through a fine-pored filter. As a filter a refined-steel tube was filled with iron powder. Lithium metal was used and Li^6 was enriched about 7%. (M.C.G.)

MATHEMATICS AND COMPUTERS

Refer also to abstract 33421.

34314 (CONF-160-1) ELECTRONIC DATA PROCESSING, AN APPLICATION TO NUCLEAR MATERIALS MANAGEMENT. J. F. Hudson (Oak Ridge Gaseous Diffusion Plant, Tenn.). [nd]. Contract W-7405-eng-26. 18p.

From Annual Atomic Energy Commission Contractors Meeting, Nuclear Materials Management, Idaho Falls, Idaho, Oct. 1963.

The application of an electronic data processing system to the unique combination of scientific and commercial data processing requirements of nuclear materials management is discussed. The organization and flow of data from the plant through the data processing equipment to the final report are discussed. Included are topics concerned with the impact of conversion to electronic data processing on personnel, materials management costs, and on other plant organizations. Portions are devoted to programming systems and decision-making abilities of data processing equipment which make these systems readily adaptable to nuclear materials management. (auth)

34315 (CREL-1123) A 1000-CHANNEL DIGITAL DISCRIMINATOR AND WINDOW SELECTOR CIRCUIT. J. A. Ladd and G. L. Harkley (Atomic Energy of Canada Ltd., Chalk River, Ont.). June 1963. 31p. (AECL-1751)

A static discriminator circuit is described which gives an output indicating whether an applied number is larger, or smaller, than a chosen number. Numbers containing three decimal digits, that is, up to 999, can be dealt with and these numbers may be applied to the discriminator in binary-coded decimal form. The development of a numerical window selecting circuit using the basic discriminator arrangement is described. The complete window switch assembly is used in a 1000-channel digital stabilizer unit. (auth)

34316 A THEOREM ON GENERALIZED HANKEL TRANSFORM. M. C. Sharma (Maharana Bhupal Coll., Udaipur, Rajasthan, India). Proc. Natl. Inst. Sci. India. Pt. A, 29: 114-18(Jan. 26, 1963). (In English)

A theorem on the generalized Hankel transform

$$f(x) = \sqrt{2}\int_0^\infty G^{q,p}_{2p,2q}\left(\frac{x^2y^2}{4}\middle| \begin{matrix} a_1, \ldots, a_p, \frac{1}{2}-a_1, \ldots, \frac{1}{2}-a_p \\ b_1, \ldots, b_q, \frac{1}{2}-b_1, \ldots, \frac{1}{2}-b_q \end{matrix}\right) g(y)dy$$

where G denotes a Meijer's function, was proved. A function which is self-reciprocal for this transform was also obtained. (auth)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

34317 (AD-413113) CRYSTALLIZATION OF THE SUPERCONDUCTOR Nb_3Sn. Report R-170. Wing C. Leung (Illinois. Univ., Urbana. Coordinated Science Lab.). May 1963. Contract DA-36-039-TR US AMC 02208(E). 38p.

Studies and experiments were conducted on the crystallization of Nb_3Sn from a saturated solution of Nb in Sn in a special furnace. Only polycrystalline clusters of Nb_3Sn crystals were obtained, possibly due to temperature fluctuations. The growth appeared in the form of layers. X-ray powder pattern analysis showed the crystals to be pure Nb_3Sn, and Pickelsimer's stain test indicated the presence of Nb_3Sn and Sn phases, in agreement with expectations. (D.L.C.)

34318 (AD-413120) PREPARATION AND EVALUATION OF HIGH PURITY BERYLLIUM. Quarterly Progress Report, April 15, 1963–July 14, 1963. G. E. Spangler, M. Herman, E. J. Arndt, D. B. Hoover, V. V. Damiano, and C. H. Lee (Franklin Inst. Labs. for Research and Development, Philadelphia). Contract NOw-63-0500-d. 39p. (Q-B2089-2)

Progress is reported of research on the production of beryllium and on its deformation and fracture characteristics. Several zone refining passes were made on extruded Be. Studies of the hot working characteristics of zone-refined Be were continued. Results of mechanical tests are reported. Electron microscopic studies of deformation in Be are described. The self-diffusion of Be parallel to the c axis was measured at 553 to 1025°C and the equation derived: $D = 0.19 \exp(-38{,}600/RT)$ cm^2/sec. (D.L.C.)

34319 (CONF-39-64) RESIDUAL AND FISSION GAS RELEASE FROM URANIUM DIOXIDE. C. N. Spalaris and F. H. Megerth (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). May 31, 1963. Contract AT(04-3)-189. 50p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

The residual and fission gas release from UO_2 was studied in laboratory and in-reactor experiments. Arc-fused powder and sintered pellets were used to determine the rate of evolution and types of residual gases as a function of temperature. Fission gas release was related to average UO_2 temperature prevalent in fuel elements studied during irradiation. The UO_2 temperature and fission gas release calculations were made using the latest thermal conductivity values, isotopic half lives, and branching ratios available in the literature. The results obtained were compared with those available in the literature, and a satisfactory agreement was found among the groups of comparable data. (auth)

34320 (DMIC-184) SUMMARY OF THE SEVENTH MEETING OF THE REFRACTORY COMPOSITES WORKING GROUP. W. A. Gibeaut and H. R. Ogden (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). May 30, 1963. Contract AF33(616)-7747. 54p.

Information on refractory composites for use above 2500°F is summarized. Reports are concerned with protective coatings, insulating ceramics, materials for rocket thrust chambers, dispersion strengthening of metals, joining of refractory materials, and testing techniques. The problem of accelerated failure of silicide coatings under conditions of very low air pressure at high temperatures is studied. Although the maximum temperature capability of most silicide coatings is reduced about 500° at low air pressures, several coatings can protect molybdenum for ½ hr at 2800 to 3000°F under these conditions. The tin-aluminum coating also is susceptible to early failure at reduced pressure. An evaluation of the mechanical properties of 6-mil foils of D-36, B-66, and TZM coated with commercial coatings demonstrated that some coatings seriously degrade substrate mechanical properties. Research on thermal-protection systems for re-entry vehicles whose surface temperatures reach from 3300 to 5500°F has resulted in agreement upon oxide coatings and thick metal-reinforced oxide composites. Simple plasma-arc-sprayed oxide coatings have demonstrated adequate oxidation resistance, but their structural stability in cyclic thermal exposure is inferior to metal-reinforced oxide. Thin unreinforced oxide coatings tend to spall in tests involving cyclic heating. A metal-reinforced oxide composite (reinforcement welded to substrate) has survived cyclic tests such as five 3-minute exposures at 4500°F without failing. A new carbon material called glassy carbon has demonstrated better oxidation resistance than pyrolytic graphite at very high temperatures. The erosion resistance of pyrolytic graphite coatings on regular graphite in rocket firing tests using solid propellants is encouraging. There is considerable interest in fabricating small radiation-cooled rocket thrust chambers by plasma arc spraying. The design concept of internal reinforcement of sprayed-metal rocket chambers with wrought ductile wire appears impractical because of poor bonding and porosity around the wire. (auth)

34321 (GEAP-4206) EVALUATION OF FAILED HOT GAS ISOSTATIC PRESSED FUEL RODS. C. J. Baroch (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.); C. B. Boyer, and S. W. Porembka (Battelle Memorial Inst., Columbus, Ohio). Mar. 20, 1963. Contract AT(04-3)-189. 44p.

Three gas pressure-bonded stainless steel-clad UO_2 fuel rods were irradiated in the VBWR to a burnup of 316 Mwd/t, and then stored in the VBWR pool for five months. During examination, the fuel rods broke into several pieces. Evaluations were conducted to determine the cause of the failure. It is concluded that the failure was caused by a very high carbon content of the cladding resulting from the binder in the UO_2 pellets, and that the carbon content led to intergranular corrosion and cracking in the VBWR pool. (D.L.C.)

34322 (HW-68600-29) PLUTONIUM ABSTRACTS. Volume 3, Number 7, (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 1, 1963. Contract [AT(45-1)-1350]. 4p.

An annotated bibliography containing 11 abstracts on plutonium technology is presented. The references are listed under the following topics: chemistry, health and safety, metallurgy and ceramics, physics, and reactor technology. (N.W.R.)

34323 (HW-SA-3014) MICROHARDNESS OF URANIUM DIOXIDE. J. Lambert Bates (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [1962]. Contract [AT(45-1)-1350]. 18p. (CONF-50-16)

From American Ceramic Society 65th Annual Meeting, Pittsburgh, Apr.-May 1963.

The deformation characteristics of uranium dioxide can be conveniently investigated by microhardness measurements. Room temperature microhardness data for single crystal and polycrystalline UO_2 show that: (1) The Knoop hardness is a function of applied load, with a maximum hardness occurring between 50 and 100 grams. (2) Knoop hardness is a function of crystal orientation with variations consistent with the symmetry of the crystal lattice. (3) Maximum hardness values of UO_2 occur on the (100) planes with the minimum hardness on the (111) planes. The average hardness of annealed single crystal UO_2 is 662 KHN. (4) Single crystal UO_2 is generally harder than polycrystalline UO_2. (5) Neutron irradiation increases the hardness of both polycrystalline and single crystal UO_2. (auth)

34324 (IDO-16887) SPERT III SPUN CAST PIPE EXPERIENCE. L. G. Gale (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). May 24, 1963. Contract AT(10-1)-205. 40p.

Centrifugally cast stainless steel piping was selected for the primary piping of Spert III, a 2500-psi, 650°F water moderated and cooled nuclear reactor system, because of the significant cost advantage of using cast piping and because of favorable results from metallurgical examinations of the material. Essentially no operating experience was available at that time on the performance of cast piping in elevated pressure and temperature service. Presented are a brief history of operational experience with this piping in Spert III, the results of a recent plant inspection, and the results of the initial metallurgical examination of centrifugally cast material. On the basis of the Spert experience, it can be concluded that centrifugally cast stainless steel pipe has given adequate service under cyclic operation and probably is equal to high-pressure stainless steel piping fabricated by other methods. However, due to the limited general use of this material, no statement can be made as to the usual commercial quality of cast piping or to its performance under conditions other than those reported. (auth)

34325 (LAMS-2949) QUARTERLY STATUS REPORT ON SOLID PLUTONIUM FUELS PROGRAM FOR PERIOD UP TO JUNE 30, 1963. J. A. Leary, W. J. Maraman, W. N. Miner, and F. W. Schonfeld (Los Alamos Scientific Lab., N. Mex.). July 1963. Contract W-7405-eng-36. 22p.

Progress in a program to investigate solid plutonium fuel compositions and their utilization in thermal, fast, and special-purpose reactors is reported. Specific phases of the program are: preparation of materials, properties of materials, physical metallurgy, irradiation effects, recycle and scrap recovery, and analytical chemistry. Program status is reviewed. (M.C.G.)

34326 (LM/TAB-22) LIQUID METALS TECHNOLOGY ABSTRACT BULLETIN FOR THE PERIOD MARCH–AUGUST 1963. (MSA Research Corp., Callery, Penna.). 19p.

A bibliography of 50 references, most with abstracts, is presented on liquid metals technology. Two of the topics covered are analytical chemistry and heat transfer. (D.L.C.)

34327 (NAA-SR-8056) GROWTH OF BeO SINGLE CRYSTALS. III. STEADY-STATE THERMAL GRADIENT METHOD. S. B. Austerman (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Aug. 15, 1963. Contract AT(11-1)-Gen-8. 19p.

The use of a steady-state thermal gradient method for growing single crystals in a molten flux has many advantages over more conventional methods. The flux system used for growth of BeO single crystals was $Li_2MoO_4-MoO_3$. The influence of temperature, thermal gradient, and flux composition parameters on crystal growth characteristics were experimentally delineated. Crystal habit, quality, and nucleation are influenced by, and are at least partially controlled by, these parameters. The significance of the data to crystal growth processes, and to the production of BeO single crystals, is discussed. (auth)

34328 (NP-12991) RESEARCH ON PHYSICAL AND CHEMICAL PRINCIPLES AFFECTING HIGH TEMPERATURE MATERIALS FOR ROCKET NOZZLES. Quarterly Progress Report, April 1, 1963–June 30, 1963. Robert Lowrie (Union Carbide Corp. Research Inst., Tarrytown, N. Y. and Union Carbide Corp. Parma Research Center, Ohio). Contract DA-30-069-ORD-2787. 65p.

The development and properties of refractory materials are described. Corrosion of zirconium carbide, niobium carbide, and niobium carbide-zirconium carbide systems by carbon dioxide and hydrochloric acid at 2250°C is reported. Corrosion of silver-tungsten alloys by carbon dioxide and oxygen at 2150 to 2440°K is summarized. Measurements of pyrolytic and ZTA graphite corrosion by carbon dioxide and oxygen at 2100 to 2800°K are shown. At 2300°C the rate of formation of methane from graphite and hydrogen is greatly reduced by the addition of helium, at constant hydrogen pressure. Up to 2000°C the effect of helium is small. The pyrolysis of methane on graphite at 2000°C is tabulated. Oxidation of tungsten to form WO_2 and WO_3 is reported. Vaporization of hafnium borides at 2297 to 2538°K is analyzed. The lattice parameters of ZrB_2 at 25, 750, 1005°C are given. The preparation and structure of $TiN_{0.8}$ and $TiN_{0.75}$ are discussed. Powder metallurgical techniques are used to prepare TiB_2, ZrB_2, HfB_2, NbB_2, and TaB_2 for detailed x-ray characterization. The electric conductivity of NbC–ZrC systems is reported. General descriptions are given of analytical techniques for free carbon in carbides and spectrographic methods for metallic impurities in carbides and borides. Preliminary room-temperature measurements are reported of the elastic properties of polycrystalline ZrB_2. Titanium carbide is brazed to tungsten with a platinum-boron system. A large-grained polycrystalline specimen of ZrC is plastically deformed in creep at 2134°C. Metallographic and x-ray examinations of polycrystalline TiC specimens deformed in creep reveal an increasing development with deformation of subgrains having preferred orientation. (N.W.R.)

34329 (TID-14146) FABRICATION, IRRADIATION, AND IRRADIATION DAMAGE STUDIES OF A HIGH-TEMPERATURE FUEL ELEMENT MATERIAL. Final Report, March 9, 1961 to June 30, 1961. C. A. Baumgartner and W. B. Shearer (Curtiss-Wright Corp. Research Div., Quehanna, Penna.). Sept. 18, 1961. Contract AT(33-3)-18. 58p. (WNQ-61-10-1)

Specimens of $UBe_{13}-ZrBe_{13}$ solid solutions were prepared for preirradiation and irradiation studies. Specimens containing 5, 10, and 20 wt percent uranium of 20% enrichment were submitted to ORNL for further study. Capsules for irradiating test specimens were designed, fabricated, and tested. Corrosion studies of the specimens submerged in NaK and sealed in the capsule were conducted at temperatures anticipated during irradiation in the MTR. No significant reaction occurred under these conditions. Techniques were developed for examining specimens fabricated. Studies of raw materials and fabricated specimens by x-ray diffraction, metallography, and chemical analyses of etching solutions indicate fabricated specimens are essentially solid solutions of UBe_{13} in $ZrBe_{13}$. Small quantities of free beryllium were detected in all specimens. Proper-

ties of fabricated specimens reported include density, modulus of rupture, hardness, grain size, chemical compositions, and corrosion resistance in NaK and air. (auth)

34330 (USBM-U-1057) QUARTERLY METALLURGICAL PROGRESS REPORT NUMBER 19, APRIL 1–JUNE 30, 1963. (Bureau of Mines. Albany Metallurgy Research Center, Ore.). Contract AT(11-1)-599. 36p.

The investigation of the stainless steel–gadolinium system was completed and the determination of physical properties was started. The study of the iron–chromium–gadolinium system was started. The solubility of selected non-rare earth alloying additions in dysprosium, erbium, gadolinium and samarium and their effect on transformation temperatures neared completion and phase diagrams were drawn. Also, the effects of the selected non-rare earth alloying additions on the oxidation and corrosion-resistance properties of dysprosium, erbium, and gadolinium were investigated. The hafnium–vanadium phase diagram was completed on resolving the vanadium solvus. The analysis of the hafnium–tantalum system was completed on the determination of the boundaries of the solid state miscibility gap by using X-ray diffraction techniques. Except for resolving the structures, melting points, and mutual solid solubilities of the compounds Hf_3Ir_2 and HfIr, the investigation of the hafnium–iridium phase diagram was completed. The hafnium-carbon system also continued to be investigated. The effects of time, temperature, and amount of cold work on the recrystallization temperature of thorium-cerium and thorium–lanthanum alloys, the measuring of hardness with varying amounts of cold work, and the preparation of tensile samples were studied. Homogeneous alloys were developed from powders of molybdenum metal with gadolinium oxide and tungsten metal with gadolinium, erbium, samarium, or europium oxides by the screen and ball-mill mixing technique; pressed powder compacts were made using a one-way press; the pressed powder compacts were sintered in hydrogen and in vacuum at different temperatures to obtain optimum densities; hammer forging and rolling experiments were conducted at various temperatures; tensile tests were partially completed, and oxidation-resistance tests were started. TIG welding of niobium was conducted in an atmosphere of helium with small controlled additions of oxygen or nitrogen or both. Embrittlement of the weld was caused by a partial pressure of any of the following in microns of mercury: 400 oxygen, 200 oxygen with 100 nitrogen, 100 oxygen with 200 nitrogen, or 400 nitrogen. Diffusion bonding of niobium at relatively low contact pressure and low temperature was attempted with indium, nickel and ultrafine tungsten powder used as interfacial materials. Data are not complete on three phases of the cold-mold crucible study; the annular water cooling space, the vertical distribution of heat, and the temperature gradient within the crucible wall. Electron beam melting of reactive metals continues, attention now being directed to yttrium and zirconium. Attempts are now in process to produce small tensile specimens of hafnium carbide. Button tests with uranium mononitride indicate the necessity for a pressurized arc furnace to prevent decomposition of the nitride during melting. (auth)

34331 (WAPD-T-1605) MATERIAL REQUIREMENTS FOR LONG-LIFE PRESSURE VESSELS. B. F. Langer (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh) and W. L. Harding (Combustion Engineering, Inc., Windsor, Conn.). May 1963. Revised June 1963. Contract AT(11-1)-Gen-14. 35p. (CONF-102-4)

To be presented at the American Society of Mechanical Engineers 1963 Winter Meeting, Philadelphia, Nov. 1963.

A treatment is given of the various possible modes of failure of a pressure vessel intended for long service and of the material properties which are of significance in preventing them. The failure modes discussed are: plastic deformation and bursting; brittle fracture; fatigue failure; creep deformation and creep rupture; and corrosion. The need for additional information in several areas is also noted. (auth)

34332 (AEC-tr-5960) A POST-MELTING EFFECT IN PURE METALS. Bruno Predel. Translated for Los Alamos Scientific Lab., N. Mex. from Z. Metallk., 54: 206-12(1963). 13p.

The current state of theories of melting is reviewed. Experimental studies of the melting process were carried out on pure Ga, In, Bi, Sm, Tl, Cd, Pb, Zn, Sb, and Al. The heating curves showed a different course from that expected after passing through the maximum. After the solid sample has melted, the temperature difference does not fall at once in accordance with the exponential law, but decreases slowly at first. The possibility of this post-melting effect being caused by errors or impurities was eliminated and various possible causes of the effect are discussed. (D.L.C.)

34333 (EURAEC-655) DIFFUSION OF RARE GASES IN SOLIDS. Quarterly Report No. 11, January 1 to March 31, 1963. (Hahn-Meitner-Institut für Kernforschung, Berlin). Apr. 1963. Work Performed under United States-Euratom Joint Research and Development Program. Contract 064-61-8 RDD. 13p. (a translation).

The use of Co monitors was introduced for simple determination of the total xenon-133 activity from Uranium-235(n,f). A discontinuous vacuum device was created, by means of which samples could be taken at intervals of one minute and the rapid argon diffusion from potassium halides thus observed. The xenon release in UO_2 monocrystals was measured at the same time as severe evaporation of the crystals occurred. Tests on crystalline uranium carbide showed that the xenon release is dependent on the neutron dose. The height of the activity burst due to the temperature increase drops when the neutron dose is stepped up. A linear xenon release in the F over Vt diagram is observed in ThO_2 crystals at temperatures below 1400°C, the samples being preheated. It was found that above 1500°C xenon release was only partial. (auth)

34334 (UCRL-Trans-969) PRECIPITATION OF Ni_3Ta FROM ALLOYS OF NICKEL TANTALUM BINARY SYSTEM. I. I. Kornilov and E. N. Pylaeva. Translated by Sergey Shewchuck (Univ. of California, Lawrence Radiation Lab., Livermore) from Dokl. Akad. Nauk SSSR, 91: 841-3 (1953). 6p.

Two methods were developed for the isolation of the compound Ni_3Ta from a Ni–39.15% Ta alloy. The first method comprises dissolving the solid solution in 5% HCl containing a few drops of HNO_3, leaving Ni_3Ta behind in the form of a fine powder. The second method, which gives a larger yield, comprises electrolytically dissolving the alloy in an alcohol–HCl electrolyte. The isolated Ni_3Ta was found to possess a hexagonal lattice. (D.L.C.)

34335 A RADIO-TRACER STUDY OF THE COMPOSITION OF ANODIC FILMS. P. H. G. Draper (Imperial Coll. of Science and Tech., London). Acta Met., 11: 1061-5(Sept. 1963). (In English)

Using S^{35} and Cl^{36} measurements were made of the uptake of anion material during the anodization of Ta and Nb in 0.1N and 100% H_2SO_4 and 0.1N NaCl. The amount taken up in dilute sulfate solution was small but appreciable; with 100% H_2SO_4 much larger quantities of active material

were found. This is much more loosely held and probably a reduction product arising as a result of the formation of oxide ions. In each of these cases the amount of extraneous material rose logarithmically with film thickness until about 60 v when a sharper rise was observed. During anodization in 0.1N NaCl solution there was no increase in Cl^- content with film thickness. It is suggested that the uptake of such material from the electrolyte considerably modifies both the film density and its electrical properties. (auth)

34336 THERMOELECTRIC POWER SYSTEMS. N. F. Schuh. Astronaut. Aerospace Eng., 1: No. 4, 80-3(May 1963).

Improvements in mechanical strength, contacting techniques, heat transfer, and utilization of available materials for improved conversion efficiency and overall in thermoelectric power systems are reported. Pb–Te, Ge–Si, and Ge–Bi–Te alloys are the thermoelectric materials considered. (C.E.S.)

34337 KINETICS OF THE REACTION OF PURE OXYGEN WITH URANIUM MONONITRIDE. Claude Moreau and Joseph Philippot (CEN, Grenoble, France). Compt. Rend., 256: 5366-9(June 17, 1963). (In French)

The reaction of oxygen on uranium mononitride between 350 and 480°C and under a pressure of 100 mm of Hg leads to an oxide of intermediary formula between U_3O_8 and UO_3. It obeys a linear kinetics with an activation energy of 24.5 kcal/mol. (tr-auth)

34338 THE PURIFICATION OF ZIRCONIUM BY THE VERTICAL ZONE FUSION METHOD UNDER ULTRAVACUUM. Jean-Paul Langeron (CNRS, Vitry-sur-Seine, France). Compt. Rend., 256: 5570-3(June 24, 1963). (In French)

The ultravacuum zone fusion installation permits a limiting vacuum of 10^{-9} Torr to be obtained. Zone fusion under a static vacuum of 10^{-7} Torr (chamber isolated from the pumping complex) can be performed. The bars obtained under these conditions after four passages have a significant purification over the major part of their length. (tr-auth)

34339 BERYLLIUM–NICKEL ALLOYS. Keith G. Wikle. Foundry, 90: 50-3(Dec. 1962).

Studies were made on the castability, at 2500°F, physical and mechanical properties, and corrosion resistance of Be–Ni alloys containing 2 to 3% Be. Data for melting, casting, annealing, hardening, and machining are also given. (TCO)

34340 HIGH RESOLUTION AUTORADIOGRAPHY OF CHEMICALLY REACTIVE SURFACES. G. T. Rogers and J. D. H. Hughes (Wantage Research Lab., Berks, Eng.). Nature, 199: 566-7(Aug. 10, 1963).

Factors affecting radioautographic resolution are reviewed. A plastic film technique is described that gives high resolution on chemically reactive surfaces. A radioautogram, replica, and micrograph of ZnS crystals coated with a tritium-containing polymer illustrate the resolution obtained in radioautograms. (C.H.)

34341 INTERACTION BETWEEN METALLIC Ti AND ZrO_2 CRUCIBLES. K. N. Repenko, N. V. Hul'ko, and I. A. Hetman. Ogneupory, No. 1, 42-5(1963). (In Russian)

Reduction of the reactability of Ti melt with the O contained in the walls of ZrO_2 crucibles was attained by the addition of CaO and Ti to the crucible material. The influence of CaO and Ti additions on the life of the crucibles used for vacuum melting, purity of Ti melt, and on wettability, porosity, microstructure, and phase composition of crucibles was investigated. (TCO)

34342 THE MIGRATION AND COALESCENCE OF INERT GAS BUBBLES IN METALS. R. S. Barnes and D. J. Mazey (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Roy. Soc. (London), Ser. A, 275: 47-57(Aug. 20, 1963). (AERE-R-4223)

Thin copper films containing 0.1 atomic percent of helium, introduced by bombardment with 38-Mev α particles, were pulse-heated at ~800°C in the electron microscope and the small helium bubbles that formed were observed and photographed after successive pulses. The bubbles could be seen to move through the copper with velocities ~1000 Å/s, exploding when they met the surface of the film, and coalescing with other bubbles that lay in their path. Measurements of the bubble radii before and after coalescence suggested that the gas in the larger bubbles obeyed the perfect gas laws and that its pressure almost exactly balanced the surface pressure of the bubble. Since no bubble was observed to reduce in size during its migration, it was concluded that helium was unable to dissolve in copper, even at high temperature. In these thin films the bubbles all moved in the same general direction, and it is thought that they migrated under the influence of the temperature gradient. The coalescence of the inert gas bubbles reduces their number, and enlarges them, and in consequence causes the metal to increase its overall volume. The observation of inert gas bubbles attached to precipitates in aluminum, beryllium, and uranium suggests that the resultant lowering of free energy when a bubble collides with a precipitate tends to anchor the bubble and restrict the volume increase. (auth)

34343 PROBLEMS IN URANIUM MONOCARBIDE AND MONONITRIDE TECHNOLOGY. L. Yakeshova. Vienna, International Atomic Energy Agency, 1963, Preprint CN-16/60, 11p. (CONF-120-25). (In Russian)

From Conference on New Nuclear Materials Technology, Including Non-Metallic Fuel Elements, Prague, July 1963.

A review is given of various technological processes for preparing powdered and compacted uranium monocarbide and mononitride. Processing of finished products is also mentioned. (R.V.J.)

Corrosion

Refer also to abstract 35084.

34344 (AD-287429) IMPROVED OXIDATION RESISTANCE OF MOLYBDENUM BY ALLOYING WITH RARE EARTH AND OTHER SELECTED METALS. Interim Report No. 5, July 1, 1962 to August 31, 1962. H. Gordon Poole (Colorado School of Mines Research Foundation, Inc., Golden). Sept. 25, 1962. Contract NOw 62-0305-d. 9p.

Continuation of Mo–Hf alloy studies using a combination of selective oxidation and sacrificial oxidation to form a protective scale is reported. An alloy containing 50 at. % Hf was preoxidized at 949°C to give a maximum opportunity for growth of a continuous inner scale of HfO_2. Oxidation of this specimen at 725°C showed that a good adherent protective scale was formed on the two flat surfaces of the specimen, but that it cracked and spalled at the edges of the specimen. The alloy itself began to crack and spall after oxidation at 725°C. Because of the spalling of the alloy, it was not considered worthwhile to run any more preoxidation experiments with a 50 at. % alloy. Work was done with 15 and 25 at. % Hf alloys which were preoxidized at 1334 and 1196°C. Subsequent oxidation showed the growth of a continuous oxide coating, but not any great resistance to O penetration. The wt changes with the 25 and 50 at. % Hf alloys showed that the scales contained a large percentage of MoO_3. (auth)

34345 (BMI-X-247) CORROSION RESISTANCE OF NICKEL-BASE ALLOYS IN A NaF–LiF–ZrF_4 SALT MIXTURE CONSIDERED FOR EBR-1 FUEL RECOVERY. P. D. Miller, E. F. Stephan, W. K. Boyd, W. N. Stiegelmeyer, and F. W. Fink (Battelle Memorial Inst., Columbus, Ohio). July 31, 1963. Contract [W-7405-eng-92]. 21p.

The corrosive effects of NaF–LiF–ZrF_4 (52-37-11 mole %), a suggested salt for EBR-1 fuel recovery, were investigated for the following Ni-base alloys: INOR-8, HyMu-80, Alloy 2 (85 Ni–10 Mo–5 Fe), ORNL 23 (Ni–5 Fe), ORNL 3 (Ni–1 Al), and INCO 61. The run was conducted for 212 hr at 650°C, and a HF sparge was used. All the alloys showed severe corrosion, especially at the liquid-vapor interface. HyMu-80 and Alloy 2 had somewhat lower rates of attack at the interface, but all the alloys had approximately the same rate of attack in the liquid. It is concluded that a lower ZrF_4 content (11 mole % as compared with ≥25 mole % in previous experiments) increased the corrosivity of the salt. (D.L.C.)

34346 (GEAP-4211) SPECIFIC ZIRCONIUM ALLOY DESIGN PROGRAM. Quarterly Progress Report No. 4, January–March 1963. H. H. Klepfer, E. L. Dunn, R. E. Blood, D. L. Douglass, and J. S. Armijo (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Apr. 1, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT (04-3)-189. 56p. (EURAEC-604)

A program is in progress for the design of a zirconium base alloy for steam service as nuclear fuel cladding. The derivation of the target properties for this design, the selection of the alloy field for study, the fabrication of 31 alloys, and the preparation of over 1800 test coupons were reported previously. Corrosion testing in high-pressure flowing steam at 300, 400, and 500°C has now reached an exposure of 2500 hours. Mathematical expressions summarizing the mechanical properties of all alloys in the alloy field for the as-fabricated condition are reported. The tensile properties of the 31 alloys tested at 300, 400, and 500°C are also reported. Post-corrosion mechanical property measurements and post-corrosion hydrogen analyses are continuing. An interim analysis of a complete data set for the 1500 hour exposure at 500°C was performed employing computer programing. Based on the results of this interim data analysis, ten more alloys are being fabricated. Fundamental studies are also in progress in support of the alloy design work. Activation analyses on stripped corrosion films have given more data on alloy element partitioning. Oxygen diffusion studies in alloy doped nonstoichiometric ZrO_2 were delayed by difficulties in the preparation of suitable samples. (auth)

34347 (IITRI-B198-43) IMPROVED ZIRCONIUM ALLOYS. Technical Progress Report, November 1, 1962–July 31, 1963. D. Weinstein and F. C. Holtz (Illinois Inst. of Tech., Chicago. IIT Research Inst.). July 30, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(11-1)-578. 43p. (EURAEC-805)

One phase of this program was the development of zirconium-base alloys superior to Zircaloy-2 in 680°F water. This objective, on the basis of corrosion resistance, tensile strength, and hydrogen pickup, was accomplished. The alloys exhibiting these enhanced properties are Zr–0.75Cr–0.4Te and Zr–0.5Nb–0.4Te as well as other compositions within this system having very similar alloy concentrations. Additional work is being carried out on these alloys for elucidation of general mechanical properties and to determine the effects of various heat treatments. A further objective of this program was the development of zirconium alloys acceptable for application in 750 and 900°F steam. Ternary alloy modifications made during the current year are presently being evaluated in these media. Preliminary data indicate that compositions in the systems Zr–Cr–Fe, Zr–V–Fe, and Zr–Nb–Te will satisfy this objective for 750°F and that alloys of Zr–Cr–(Te, Fe, Nb) and Zr–V–(Mo, Te) might be suitable for use at 900°F. Further corrosion data for long exposure times are being obtained so that more specific compositions will be indicated. (auth)

34348 (ORNL-3131) IN-PILE LOOP CORROSION EXPERIMENTS WITH URANYL SULFATE SOLUTIONS AT 235 AND 250°C. G. H. Jenks and J. E. Baker (Oak Ridge National Lab., Tenn.). Aug. 15, 1963. Contract W-7405-eng-26. 150p.

In-pile loop experiments DD, EE, FF, GG, L-4-12, L-4-13, and L-4-18 were seven of a series designed to test the radiation corrosion of zirconium, titanium, and stainless steel alloys in UO_2SO_4 solutions under various conditions of radiation intensity, temperature, solution composition, and velocity of flow. Also investigated to a lesser extent were the effects of the in-pile exposure on impact and tensile properties of various structural materials, solution stability under irradiation, rate constants for recombination of radiolytic gas by copper in solution, and the general reliability of equipment operating under the test conditions. Steel specimens exposed in the loop cores showed increases in corrosive attack over that expected out-of-radiation. The average rates of corrosion increased with power density in adjacent solution, but below certain power densities (0.3 to 4.2 w/ml in the various experiments) the average rate was not noticeably different from that occurring on in-line specimens, nor significantly different from that expected during out-of-pile exposures. These results, indicating that the effects of in-pile exposure on steel corrosion were confined to the core, were obtained from weight-change data, oxygen consumption rates, and measurements of nickel accumulation in solution, as well as from metallographic and visual examinations of specimens and components. Stainless steel corrosion rates probably changed considerably during the course of an experiment as indicated by the changes in the rate of oxygen consumption, varying by a factor of about 40 in one experiment and by a factor of 2 in another. No effect of stress or of galvanic coupling with other materials was noted in the corrosion behavior of stainless steel specimens located in the core and in-line positions. In one experiment a definite couple attack was noted between a 17-4 PH steel stress specimen and a C-130 AM titanium-alloy specimen located in the loop pressurizer. In the 235°C experiment, type 430L stainless steel specimens were affected by exposure to fissioning solution to about the same extent as type 347 stainless steel. In a 250°C experiment, type 309SCb stainless steel exhibited about the same general relationship between power density and rate as type 347 stainless steel, but at a given power density the type 309 rates were greater than those for type 347. Data obtained in these and other experiments of the series indicate both adverse and beneficial effects on steel corrosion under exposure to fissioning uranyl sulfate solutions with increasing solution velocity. The experimental conditions under which one or the other of the effects predominates are unknown, but it is speculated that the beneficial effect may result from a reduction of sorbed uranium on the steel surfaces, and the adverse effect to result following damage to the protective film during irradiation. It was concluded that the average rate of steel cor-

rosion in the loop cores in the 250°C experiments was dependent on the concentration of excess H_2SO_4 and $NiSO_4$ in the loop solution, the rate decreasing with decreasing acid and with increasing $NiSO_4$. The most likely explanation for these effects is that the corrosion was influenced by the hydrogen ion concentration at the exposure temperature, and that the $NiSO_4$ in solution tended to reduce this concentration through the formation of HSO_4^-. This ion is known to be very stable at 250°C. Analyses of solution samples withdrawn periodically from the experiments indicated, on the average, no significant loss of uranium or sulfate from solution. Loss of copper from solution ranging from 1 to 11% was indicated in most of the experiments. Copper rate constants at 250°C, based on an activation energy of 22,000 kcal/mole for the copper activity, ranged from 2400 to 3200 liters $mole^{-1}$ hr^{-1} and are in reasonable agreement with those determined in out-of-pile tests. The constants in the experiments employing D_2O solutions were below those measured or predicted for water solutions. Corrosion data for zirconium and titanium alloys obtained in these experiments are presented but not discussed, since they are in general agreement with other data for these materials which have been reported and extensively discussed elsewhere. (auth)

34349 (ORNL-TM-622) OBSERVATIONS ON THE OXIDATION OF BERYLLIUM IN CO_2 BY USE OF $C^{14}O_2$ AND AUTORADIOGRAPHIC TECHNIQUES. H. E. McCoy, Jr. (Oak Ridge National Lab., Tenn.). Aug. 22, 1963. Contract W-7405-eng-26. 36p.

Because of the proposed use of beryllium as a fuel-cladding material in a CO_2-cooled reactor, the compatibility of beryllium and CO_2 at elevated temperatures is of interest. The reported breakaway or nonprotective oxidation of beryllium in CO_2 under certain test conditions and the proposed relation of this phenomenon to carbon absorbed during the oxidation stimulated a brief study to determine the reaction products formed and their location. A limited number of tests were run at a pressure of 200 mm Hg in $C^{14}O_2$ at temperatures between 593 and 815°C for times up to 500 hr. The specimens were examined after test using metallographic, autoradiographic, and surface-counting techniques. It was found that the reaction products of the beryllium with CO_2 were BeO and Be_2C. The reaction proceeded along preferred longitudinal directions that seemed to be influenced by the voids present in the as-received material. The reaction advanced more rapidly in the longitudinal than in the transverse direction. Three possible mechanisms were proposed to account for the greater rate in the longitudinal direction based upon an excess concentration of vacancies in the oxide film from the voids, the segregation of impurity atoms around the voids, and the inability of the material to deform plastically in certain directions due to preferred orientations of the grains. It was found that the beryllium specimens increased in carbon content during exposure to CO_2. The carbon was found to remain associated with the reaction product and did not diffuse into the beryllium. (auth)

34350 THE EFFECT OF SURFACE TREATMENT ON THE CORROSION OF STAINLESS STEEL IN WATER AND STEAM AT HIGH TEMPERATURE. Madeleine Warzée, Philippe Berge, Marcel Maurice, and Jean Waty. Compt. Rend., 256: 5566-7(June 24, 1963). (In French)

Samples of austenitic stainless steel 18-10 were exposed to different surface treatment (milling, machine rectification, paper polishing, and electrolytic polishing). The autoclave tests in water (300°C) and in water vapor (400°C, 200 kg/cm^2) comprised periods up to 2000 hr. The behavior of the electrolytically polished samples was sharply distinguished from samples having other treatment. But, whereas the electrolytic polishing causes a very significant improvement in water at 300°C, the treatment has no effect in vapor at 400°C. (tr-auth)

34351 OXIDATION IN AIR AND IN OXYGEN-POOR ATMOSPHERE OF AN Fe-Cr STEEL AND Fe-Cr-Ni STEEL. R. Castro and J. Decroix. Corrosion Anti-Corrosion, 11: 219-30(June 1963). (In French)

A micrographic study was made of the oxidation layers produced in air from 700 to 1100°C and in oxygen-poor atmosphere from 1000 to 1300°C on Cr and Cr-Ni stainless steel. The oxidation tests in air showed the appearance of oxide penetrations accompanied by surface pustules and associated with the formation of a spinel phase. This phenomenon is preceded, in Cr-Ni steel, by intergranular penetration. In nitrogen atmosphere with 0.1% oxygen, an important internal oxidation, by formation of polyhedric nodules of spinel oxides, was observed at 1200 to 1250°C. The mechanisms of these two types of oxidation are discussed for a steel with 17% Cr and one with 18% Cr and 10% Ni. (tr-auth)

34352 ROLE OF MOLYBDENUM IN CORROSION-RESISTANT MATERIALS. PART 2. G. F. P. Fox. Corrosion Prevent. Control, 9: 43-7(Dec. 1962).

The corrosion resistance of Mo-containing Ni, Zr, and W alloys and commercially pure Mo to various corrosive environments, including acids, CO_2 gas and liquid metals was studied. (Rev. Metal Lit., 20: No. 3, March 1963)

34353 METAL DEPOSITION ON URANIUM TO INHIBIT CORROSION. Corrosion Technol., 10: No. 2, 43 (Feb. 1963).

The electrodeposition of Cu, Ni, and Cr from aqueous solutions and of Zn and Al from ether solutions on U was investigated. Porosity of the coatings was determined by testing with hydrogen at 200°C. (Rev. Metal Lit., 20: No. 4, April 1963)

34354 OXIDATION CHARACTERISTICS OF NIOBIUM. Metal Treat. Drop Forging, 29: 496-7(Dec. 1962).

Weight gain in Nb during oxidation was measured, using a balance technique, for oxidation at 336 to 475°C. The formation and composition of the oxide surface layer was determined by microscopic and electron diffraction methods. (Rev. Metal Lit., 20: No. 3, March 1963)

34355 CORROSION OF TD NICKEL. W. L. Phillips (E. I. du Pont de Nemours and Co., Wilmington, Del.). 26p. (CONF-21-1)

From National Association of Corrosion Engineers Meeting, New York, Mar. 1963.

The corrosion rates of TD Nickel (Ni-2% ThO_2) and A Nickel were measured in mineral acids, organic acids, sodium sulfate-sodium chloride mixtures, lead salts, and fuel ashes. Corrosion resistance was evaluated by weight loss and surface recession measurements. Corrosion attack was more uniform in TD Nickel than in pure nickel. The presence of a dispersion of sub-micron thoria also changed the attack mode as evaluated by electron microscope examination. TD Nickel was, in general, superior to A Nickel in all environments tested. (auth)

34356 A LABORATORY TEST FOR DETERMINING SUSCEPTIBILITY OF NICKEL-MOLYBDENUM AND NICKEL-MOLYBDENUM-CHROMIUM ALLOYS TO INTERCRYSTALLINE CORROSION AND ITS USE IN THE DEVELOPMENT OF RESISTANT ALLOYS. Hubert Graefen (Badische Anilin-und-Sodafabrik, Ludwigshafen, Ger.). 47p. (CONF-28-1)

From International Congress on Metallic Corrosion, New York, Mar. 1963.

A rapid testing method for the determination of intercrystalline corrosion in Ni–Mo and Ni–Mo–Cr alloys is presented. Strips or bars of the alloys are placed for 24 hours in boiling 10% hydrochloric acid and then bent. Corrosion of grain boundaries becomes evident by tearing in the area of grain boundaries on bending. Hastelloy C was used as a test sample. Intercrystalline corrosion diagrams are illustrated. (C.E.S.)

34357 ZIRCONIUM ALLOYS OF HIGH CORROSION-RESISTING QUALITIES. Th. Raine and Th. Alan Robinson (to Associated Electrical Industries Ltd.). German Patent 1,149,909. June 6, 1963. Priority date June 11, 1959, Great Britain.

The zirconium alloy described displays high corrosion-resisting qualities against extended exposure to a watery medium, e.g., water vapor at 1 atm. and at temperatures of 500°C. This alloy is composed of 0.75 to 1.25% copper, 0.25 to 0.75% tin, and the rest zirconium containing the unavoidable impurities. A preferable composition consists of 1.0% copper, 0.5% tin, and the rest zirconium. (Gmelin Inst.)

Fabrication

Refer also to abstract 33423.

34358 (ASD-TDR-63-581) MACHINING OF REFRACTORY MATERIALS. Final Technical Report. Norman Zlatin, Michael Field, William P. Koster, and John V. Gould (Metcut Research Associates Inc., Cincinnati). May 1963. Contract AF33(600)-42349. 348p.

Machining characteristics are presented for unalloyed tungsten; molybdenum, niobium, and tantalum alloys; Renè 41; B-120 VCA titanium; D6AC steel 52-58R_c; Refrasil; Pyroceram; zirconium oxide; and aluminum oxide coatings. These represent some of the most difficult to machine materials presently being fabricated into aerospace components. Test data are also included on high-speed edge milling of high temperature sheet materials and the Tornetic system of drilling and tapping. (auth)

34359 (BMI-1640) USE OF AGGLOMERATED UO_2 IN PRESSURE-BONDED STAINLESS STEEL-CLAD FUEL RODS. Edwin S. Hodge, Stanley W. Porembka, Charles B. Boyer, and Robert J. Diersing (Battelle Memorial Inst., Columbus, Ohio). July 23, 1963. Contract W-7405-eng-92. 30p.

In a continuation of the Hanford-Battelle cooperative program, the combined use of the vibrational-compaction and gas-pressure-bonding processes for fabricating UO_2 fuel elements was studied. Particular emphasis was placed on the use of agglomerated micronized UO_2 to overcome nonuniformities in the vibrationally compacted pressure-bonded fuels. Inconel-X-clad fuel rods were gas-pressure bonded at 2100°F for 3 hr at 10,000 psi to evaluate the use of micronized UO_2 agglomerated by cold high-energy-rate forming methods. Fuel densities from 88 to 93% of theoretical were attained. A limited parallel study was also conducted to evaluate hydrostatic pressing as a method of agglomerating micronized UO_2. Tap density increased from 20 to 25% for the as-received micronized oxide to 41% for the hydrostatically agglomerated plus 200-mesh powder. Studies of the effects of prior cold work and gas-pressure bonding on the mechanical and physical properties of types 304L and 347 stainless steel were conducted. Prior cold work in the range of 35 to 50% gave a pressure-bonded structure having a fine grain size. (auth)

34360 (CONF-94-5) JOINING OF EXOTIC MATERIALS. G. M. Slaughter (Oak Ridge National Lab., Tenn.). [nd]. Contract W-7405-eng-26]. 2p.

From American Nuclear Society Meeting, Cincinnati, April 1963.

The developments in the joining of refractory materials at ORNL are reviewed with respect to nuclear reactor technology. Information is presented on the brazing and welding of niobium, beryllium, graphite, oxides, and alloys. (N.W.R.)

34361 (CONF-127-1) RECENT ADVANCES IN THE POWDER METALLURGY OF URANIUM CARBIDE. Herbert S. Kalish (United Nuclear Corp. Fuels Div., New Haven). Oct. 31, 1962. Contract AT(30-1)-2374. 22p.

From MPIF-ASM Powder Metallurgy Symposium National Metals Congress, New York, October–Nobember 1962.

An economical method of fabricating uranium carbide by the powder metallurgy approach is discussed. To prepare uranium carbide, uranium metal is converted to uranium hydride powder and then carburized using propane gas. The carbide particles are irregular, of a relatively uniform size, and highly pyrophoric. Paraffin, camphor, cetyl alcohol, beeswax, and carbowax are used as lubricants and binders for compacting uranium carbide powder. Sintering studies were conducted for various times and temperatures, primarily in vacuum. An investigation is in progress to evaluate the effect of carbon content on the properties and irradiation stability of uranium carbide. It is shown that the powder metallurgy technique achieves a product with reasonably good density and apparently adequate properties for reactor utilization. (M.C.G.)

34362 (EURAEC-701) FISSION GAS RELEASE FROM URANIUM DIOXIDE. Topical Report on UO_2 Pellet Fabrication and Characterization. Ignazio Amato (FIAT. Sezione Energia Nucleare, Turin). May 1, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 021-60-9 RDI. 26p. (FN-E-34)

Fabrication and characterization of the UO_2 pellets performed in FIAT in order to obtain the 81 specimens selected according to a statistical design of the experiments are described in detail. Hydrogen sintering was used to pelletize three ceramic grade UO_2 powders of different origin: Mallinckrodt (natural and 3 percent enriched), C.E.A. (natural), and C.N.E.N. (natural). Mallinckrodt and C.E.A. powders were produced with dry methods (calcination and hydrogen reduction) whereas the C.N.E.N. powder was produced with a wet method (precipitation of UO_2 hydrate from solution in reducing medium, and hydrogen calcination of the obtained powder). Characterization of the UO_2 powders was done by measuring the following properties: real density (CCl_4), tap density, O/U ratio, average particle diameter (Fisher), total surface area (BET), external surface area (Blaine), roughness factor, open porosity distribution (pressurized mercury technique), differential thermal analysis (DTA). Characterization of the pellet samples was done by measuring the following properties: density, open and closed porosity as a function of density, open porosity distribution (pressurized mercury technique), grain size, and closed porosity (micrography). (auth)

34363 (GEAP-4257) DESIGN AND FABRICATION OF FUEL RODS CONTAINING LOW TEMPERATURE SINTERED PELLETS. C. J. Baroch (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). May 15, 1963. Contract AT(04-3)-189. 20p.

A process has been developed at United Nuclear Corporation (UNC) in which UO_2 pellets are sintered at 1100 to 1300°C rather than at 1600 to 1700°C as in the conventional process. This process shows potential of providing a more economical method for the preparation of UO_2 pellets than does the conventional process. Because of the favorable economics of the low-temperature sintering process, it was considered advantageous to evaluate the irradiation characteristics of the pellets produced by this process. Therefore, UNC manufactured several fuel rods containing low-temperature-sintered pellets. The fuel rods, other than the pellets, were fabricated in a similar manner as the fuel rods for commercial power reactors. The UO_2 pellets, however, were prepared in the following manner: (1) UO_2 powder was activated by a thermal process involving oxidation, pyrohydrolysis, and subsequent reduction with hydrogen; (2) the activated powder was roasted in air to introduce excess oxygen; (3) the oxidized powder was mixed with a binder, sized, and then pressed into pellets using a pressure of 20 tsi; (4) the green pellets were sintered in nitrogen for one hour at 1150°C and then in hydrogen for 2.5 hours. The sintered pellets met dimensional specifications and, therefore, grinding was not necessary. The pellets were then inserted into stainless steel tubes which were sealed by welding in end plugs. Three of these fuel rods were sent to Atomic Power Equipment Department for irradiation in the Vallecitos Boiling Water Reactor. These fuel rods were inserted in a special fuel assembly and the irradiation was begun in July, 1962. The irradiation will continue until an average burnup of at least 10,000 (Mwd/t) has been achieved. (auth)

34364 (LADC-5851) SPECIMEN PREPARATION FOR TRANSMISSION ELECTRON MICROSCOPY OF ALPHA URANIUM. Dana L. Douglass (Los Alamos Scientific Lab., N. Mex.). [1962]. Contract [W-7405-eng-36]. 3p. (CONF-105-1)

From AEC Metallography Meeting, Los Alamos, N. Mex., May 1963.

Thin films of alpha uranium are prepared by electropolishing in a bath composed of 25 g chromic acid, 133 ml glacial acetic acid, and 25 ml water. Since the electrolytic thinning produces wedge-shaped specimens, the sample is rotated 90° in its own vertical plane every few minutes to minimize this effect. Upon completion of the thinning, the specimens are rinsed in anhydrous methanol and dried in a warm air stream before being studied by transmission electron microscopy. (N.W.R.)

34365 (LADC-5598) CERAMIC MATERIALS FOR NUCLEAR THERMIONIC CONVERTERS. Robert E. Cowan and Stephen D. Stoddard (Los Alamos Scientific La. Los Alamos). [1963]. Contract [W-7405-eng-36]. 21p. (CONF-50-1)

From American Ceramic Society Meeting, Pittsburgh, Apr.-May 1963.

The development and fabrication of ceramic-to-metal seals for thermionic converters which will operate in the temperature range of 700 to 1200°C are reported. Two ceramic-to-metal seal combinations were developed which show promise for specialized applications. For operation in an oxidizing atmosphere near 700°C, magnesia and nickel appear to be a good combination. Seals operating near 1200°C, if an oxidizing atmosphere is not present, may be composed of niobium and alumina with palladium serving as the brazing filler. The tungsten metallizing of alumina which contains yttria is a process which appears to have considerable merit. A reaction between the tungsten and yttria is thought to result in an improved ceramic-metal bond. (N.W.R.)

34366 (LAMS-2917) CERAMIC-TO-METAL SEALS FOR HIGH TEMPERATURE OPERATION. E. L. Brundige and G. S. Hanks (Los Alamos Scientific Lab., N. Mex.). Apr. 1, 1963. Contract W-7405-eng-36. 36p.

Ceramic-to-metal seals for operation at temperatures up to 1500°C can be fabricated through the use of tungsten-metallized alumina bodies brazed to niobium-zirconium alloy components with palladium braze metal. Seals for operation at 1000°C or lower can be made using palladium-cobalt braze alloy. The braze metal can be added as a foil or by plating. (auth)

34367 (NP-13027) MANUAL OF METAL-TO-CERAMIC SEALING TECHNIQUES. C. W. Johnson and E. W. Cheatham (Sperry Gyroscope Co. Electronic Tube Div., Great Neck, N. Y.). May 1963. Contract AF30(602)-2371. 60p.

Procedures for fabricating metal-to-ceramic seals are presented. Five statistically designed experiments were performed to examine the significance of the variables and their interactions on overall seal strength. Topics covered include: selection of raw materials, seal design, parts preparation and metallizing, fixtures and assembly, brazing, control testing, and failure analysis. (M.C.G.)

34368 (NP-13045) THE STATE-OF-THE ART OF WELDING OF REFRACTORY METALS. D. J. Seman and F. D. Seaman (Universal-Cyclops Steel Corp., Bridgeville, Penna.). June 1963. Contract NOw-63-0043-c. 122p.

An industrial survey is presented of the state-of-the-art of refractory metal welding. The number and types of facilities engaged in refractory metal welding are summarized, and the nature of current welding operations on refractory metals is reviewed in detail. Finally, the current methods and limitations are discussed with respect to future needs. (D.L.C.)

34369 (RBESO-3404-3) CERAMIC TO METAL SEALS FOR HIGH-TEMPERATURE THERMIONIC CONVERTERS. Quarterly Technical Report No. 3. (Bendix Corp. Red Bank Div., Eatontown, N. J.). July 15, 1963. Contract AF 33(657)-10038. 46p. (AD-410101)

The objective of this program is to develop seals which are capable of long life at 1500°C in cesium and vacuum environments, and to extend the sealing techniques developed to materials which are capable of long life at temperatures in excess of 2000°C. Work completed has enabled fabrication of alumina-molybdenum structures which can resist a 1500°C environment. Ceramic-refractory metal systems were identified which are stable and usable up to 2000°C. Preliminary experiments to determine means of bonding these materials for use at 2000°C were successful. Elimination of materials which are unstable when in the presence of cesium minimizes possible corrosion effects. Recommendations are made for limitation of the development activities to the most promising joint systems. (auth)

34370 (TID-19154) FABRICATION OF STAINLESS STEEL FOR AGGRESSIVELY CORROSIVE RADIOACTIVE SERVICE. W. H. Koontz (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 31, 1963. Contract [AT(45-1)-1350] 6p. (HWS-5936)

Specifications are presented for the fabrication of stainless steel vessels, piping, and other equipment for the chemical processing of radioactive, corrosive materials. The specifications cover standards of fabrication, materials, handling and working, assembly, welding, testing, and cleaning and painting. (D.L.C.)

34371 (TID-19155) SPECIFICATION. FABRICATION OF STAINLESS STEEL SHELL AND TUBE HEAT EXCHANGERS FOR AGGRESSIVELY CORROSIVE RADIOAC-

TIVE SERVICE. W. H. Koontz (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 31, 1963. Contract [AT(45-1)-1350]. 3p. (HWS-5937(Rev.1))

The special requirements for the fabrication of stainless steel shell and tube heat exchangers for use in chemical processing of highly radioactive aggressively corrosive solutions are specified. (N.W.R.)

34372 (TID-19156) SPECIFICATION. FABRICATION OF STAINLESS STEEL FOR MILDLY CORROSIVE RADIOACTIVE SERVICE. W. H. Koontz (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 31, 1963. Contract [AT(45-1)-1350]. 6p. (HWS-5938(Rev.3))

The requirements for fabrication of stainless steel vessels, piping and piping systems, and other equipment for the chemical processing of highly radioactive, mildly corrosive materials are specified. (N.W.R.)

34373 (TID-19157) SPECIFICATION [FOR] WELDING OF STAINLESS STEEL FOR CRITICAL WELDS FOR AGGRESSIVELY CORROSIVE RADIOACTIVE SERVICE. P. S. Kingsley (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 5, 1963. Contract [AT(45-1)-1350]. 10p. (HWS-8240(Rev.3))

The requirements for fusion welding of critical welds in stainless steel vessels, piping and piping systems, and other equipment for use in the chemical processing of highly radioactive aggressively corrosive materials are specified. (N.W.R.)

34374 (TID-19158) WELDOR PERFORMANCE QUALIFICATION PROCEDURE. P. S. Kingsley (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 1, 1963. Contract [AT(45-1)-1350]. 14p. (HWS-8225(Rev.5))

The requirements for weldor qualification for stainless steel welding utilized in the fabrication of chemical processing equipment for the Hanford Atomic Products Operation are specified. (N.W.R.)

34375 (TID-19159) SPECIFICATION [FOR] RADIOGRAPHIC TESTING OF STAINLESS STEEL WELDMENT. R. B. Socky (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 30, 1963. Contract AT(45-1)-1350. 58p. (HWS-8227(Rev.2))

Specifications for radiography of welds of stainless steel are presented. Applications are discussed. Procedure is described, including radiographic quality level, penetrameters, techniques, processing, viewing, and interpretation of radiographs. Acceptance standards are included. (M.C.G.)

34376 (TID-19160) SPECIFICATION [FOR] WELDING OF STAINLESS STEEL FOR PROCESS QUALITY WELDS FOR MILDLY CORROSIVE RADIOACTIVE SERVICE. P. S. Kingsley (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 10, 1963. Contract [AT(45-1)-1350]. 9p. (HWS-8241(Rev.4))

The requirements for fusion welding stainless steel vessels, piping and piping systems, and other equipment used in the chemical processing of highly radioactive, mildly corrosive materials are specified. (N.W.R.)

34377 (TID-19268) AN INEXPENSIVE RESISTANCE WELDER FOR THERMOCOUPLE FABRICATION. R. McDonough and H. A. Hawthorne (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). [nd]. Contract AT(04-1)-Gen-12. 6p.

Iron-constantan thermocouples were adopted for studying temperature regimes in a desert area in ecological studies. A resistance welder is described for joining iron and constantan wires by fusion. A carbon rod is used as one electrode of the welder, and the heating is effected by transfer of ampere currents across the low contact resistance between the carbon rod and a pair of thermocouple wires. (D.L.C.)

34378 THE FACTS ABOUT ELECTRON BEAM WELDING. James R. King. Assembly & Fastener Eng., 6: No. 3, 24-9(Mar. 1963).

The vacuum chamber, vacuum pumping system, electrical controls, and the electron beam gun for welding of Cu, Ti, W, Cb, Mo, Ta, Be, Haynes alloy 25, Rene 41, Zircaloy, Al, or stainless steel is discussed. The influence of penetration, joint geometry and specific heat, melting point, and thermal conductivity of material on joint efficiency, heat affected zone, brittleness, cracking, shrinkage, distortion, and welding stresses are considered. (Rev. Metal Lit., 20: No. 6, June 1963)

34379 HOW CANADA MET THE CHALLENGE. AECL PROJECT PART 1. Ian Morris. Can. Metalworking, 26: No. 3, 27-9(Mar. 1963).

A review is given of the general fabrication and components of an atomic reactor capable of constant reactivity over a two year period, depending upon fuel bundle energy. The use of stainless steel and Zircaloy materials in the moderator vessel, end shielding, and coolant assemblies is also discussed. (Rev. Metal Lit., 20: No. 6, June 1962)

34380 EXTRUDING AND MACHINING STAINLESS STEEL TO TOLERANCES OF ± .0001. AECL PROJECT PART 2. Ian Morris. Can. Metalworking, 26: No. 3, 30-3 (Mar. 1963).

Extrusion with a 12,000-ton press and a machining procedure for manufacturing 403 stainless steel end fittings for atomic reactors is presented. The extrusion method gives a very high reduction ratio as compared with the normal forging process. The grain structure is refined and mechanical properties enhanced to the point where longitudinal and transverse properties are practically equal. (Rev. Metal Lit., 20: No. 6, June 1963)

34381 MASS PRODUCING THE FUEL BUNDLES. Can. Metalworking, 26: No. 3, 38-41(Mar. 1963).

The assembly and autoclaving procedures for fuel bundles that consist of uranium dioxide pellets sealed in a thin Zircaloy sheath, to which a wire wrap is welded to form a coarse double start helix are presented. Resistance welding procedures and inspection details for the pellets and Zircaloy-2 components are also given. (Rev. Metal Lit., 20: No. 6, June 1963)

34382 KEEP OUT INCLUSIONS IF YOU WANT TO WELD ATOMIC AGE METALS. Can. Metalworking, 26: No. 3, 49-51(Mar. 1963).

The basic principles for welding Zr, Mo, Be, Ti, and Ta by the tungsten inert gas shielded process with the welds made inside a dry box are presented. Weldability depends on the successful exclusion of the common reactive gases, particularly oxygen, nitrogen, and hydrogen. (Rev. Metal Lit., 20: No. 6, June 1963)

34383 HYBRID METALS FOR RADIATION SHIELDING. J. Grindrod. Eng. Materials Design, 6: No. 4, 250(Apr. 1963).

Lead was strengthened for shielding by bonding to Al, Cu, carbon steel, stainless steel, Ni alloy, and combinations of paraffin wax and polythene to enhance its ability to withstand heat and to assist the metal to transfer its heat efficiently and to better its mechanical strength and other properties. (TCO)

34384 BETA TREATMENT OF URANIUM. Ko Soeno. Hitachi Hyoron, 11: 29-36(Dec. 1962).

Measurements of the preferred orientation in uranium plates, determined by measuring the anisotropy of the thermal expansion coefficient and amount of deformation after thermal cycling, were used to show the effects of beta treatment on the dimensional stability. (Rev. Metal Lit., 20: No. 5, May 1963)

34385 EFFECT OF COLD ROLLING AND ANNEALING OF THE NUCLEAR MAGNETIC RESONANCE SPECTRUM OF ^{63}Cu IN COPPER SHEETS. Kálmán Tompa and Ferenc Toth. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 11: 215-25(1963). (In Hungarian)

Nuclear magnetic resonance spectrum of Cu^{63} nuclei was investigated on cold rolled and annealed copper sheets, at room temperature, for various orientations of the sample with respect of the external magnetic field. The second moment of the absorption curve as well as the peak-to-peak amplitude of the derivative of the resonance line showed a marked anisotropy depending on the previous thermal history of the sample. For an annealed sample the second moment of the resonance line decreased, the peak-to-peak amplitude of the derivative increased as compared with those for the rolled sheets. The anisotropy of the second moment of the nuclear magnetic resonance line can be interpreted with Van Vleck's theory assuming (100)[001] type cube recrystallization texture. The measured values of the second moment, however, like in the case of powder samples and monocrystals, are higher than those predicted by the theory. (auth)

34386 THE SCOPE OF ELECTROCHEMICAL MACHINING. Mass Prod., 39: No. 1, 79-89(Jan. 1963).

Electrolytic surface grinding, drilling, broaching, and cutting of Al, Be, Cr, Co, Nb, Cu, Fe, Mo, Ni, Ta, Ti, W, Zr, stainless steel, Rene, 41, and Waspaloy parts are discussed. Consideration is given to factors such as tool erosion, development of heat or friction, surface finish, and tolerance. (Rev. Metal Lit., 20: No. 4, April 1963)

34387 SURFACE TREATMENTS AND ELECTROPLATED COATINGS ON URANIUM. James K. Gore and Robert Seegmiller. Plating, 50: 215-20(Mar. 1963). (TID-14525; LADC-5106)

Procedures for obtaining satisfactory electrodeposits of Ag or Cu on uranium are discussed. Because a method of achieving true chemical bonding of plated deposits has not yet been developed, the surface of the uranium must be roughened to give mechanical adhesion. A review of etching and chemical bonding techniques is also presented. Plating is usually harmful to the corrosion resistance of uranium. (Rev. Metal Lit., 20: No. 5, May 1963)

34388 ZIRCONIUM-CARBIDE-COATED URANIUM-OXIDE FUEL PARTICLES. W. J. K. Davies, A. G. Thomas, J. B. Huffadine, and N. C. Moore (Plessey Co. Ltd., Towcester, Northants, Eng.). Trans. Brit. Ceram. Soc., 62: 269-79(Mar. 1963).

The development of vapor plating is briefly reviewed and previous work carried out on the preparation of zirconium carbide by the method is outlined. The problems of applying vapor-deposited coatings to powders are enumerated, and possible solutions to the problems are discussed. The system chosen for study involves the deposition of zirconium carbide in a dense, non-porous form on particles of uranium dioxide ranging in size from 25 to 500 μ in diameter. A deposition temperature in excess of 1500°C is necessary and the design and operational problems resulting from this are discussed. The results of experiments carried out in fluidized beds and rotating crucibles are outlined. The influence of experimental variables on the form of coating produced is examined by x ray and microscope methods. In addition, the fission-product release from an irradiated sample of coated uranium dioxide shows the material to compare favorably with others previously investigated. (auth)

34389 VAPOUR PHASE DEPOSITION OF MOLYBDENUM ON URANIUM DIOXIDE PARTICLES USING FLUIDIZED BED TECHNIQUE. H. S. Gadiyar and J. Balachandra. Trans. Indian Inst. Metals, 15: 168-76 (Sept. 1962).

Vapor phase hydrogen reduction and the deposition of molybdenum pentachloride to produce metallic Mo coatings on UO_2 nuclear fuel particles prior to sintering was investigated. Data are given for the deposition rate as a function of temperature (400 to 800°C), time (0.5 to 2.5 hr), and argon and hydrogen content. (Rev. Metal Lit., 20: No. 5, May 1963)

34390 FUEL MANUFACTURING DEVELOPMENT FOR THE NPD REACTOR. J. G. Matthew (Canadian General Electric Co., Ltd., [Toronto]). 20p. (CONF-11-2)

From Winter Meeting of the American Nuclear Society, Washington, D. C., Nov. 1962.

The manufacturing development of natural uranium dioxide sintered pellets in Zircaloy-2 tubular sheaths as the fuel element for the NPD reactor is presented. Fuel performance requirements are outlined. The development of the uranium dioxide pellets and Zircaloy tubing is discussed. Element closure welding, wire wrap welding, pickling and autoclaving, and bundle assembly welding are also described. (C.E.S.)

34391 METHOD FOR PRODUCING NUCLEAR FUEL ELEMENTS CONSISTING OF A MIXTURE OF URANIUM OXIDES. G. Elliot Christie (to United Kingdom Atomic Energy Authority). German Patent 1,148,663. May 16, 1963. Priority date July 19, 1958, Great Britain.

The method given is for producing nuclear fuel elements consisting of a mixture of uranium oxides the sintering qualities of which are comparable to those of non-stoichiometric UO_2. The method comprises the steps of preparing a mixture of UO_2- and U_3O_8-powder, the U_3O_8 content being 5 to 45 wt %, of compacting this mixture, and of pressing and sintering the compact in an inert gas atmosphere at a temperature of 1200 to 1500°C. (Gmelin Inst.)

Properties and Structure

Refer also to abstract 35189.

34392 (AERE-R-4334) A METALLOGRAPHIC TECHNIQUE FOR DISTINGUISHING BETWEEN METAL AND SESQUICARBIDE PHASES IN THE U–C AND $(U_{85}Pu_{15})$–C SYSTEMS. H. E. Chamberlain and E. L. Paige (United Kingdom Atomic Energy Authority, Research Group, Atomic Energy Research Establishment, Harwell, Berks, England). June 1963. 9p.

It is impossible to differentiate between traces of metal and sesquicarbide phase in some specimens of U–C and (UPu)–C using conventional metallographic procedures. The use of a dilute bromine solution, which preferentially attacks U and UPu metal phases, has provided a satisfactory technique. (auth)

34393 (AGN-8088) RUBIDIUM/CESIUM EVALUATION PROGRAM. Quarterly Progress Report, April 1 through

June 30, 1963. C. R. Fisher and P. Y. Achener (Aerojet-General Nucleonics, San Ramon, Calif.). July 22, 1963. Contract AT(04-3)-368. 39p.

An experimental program is being carried out on the characteristics of rubidium and cesium at temperatures up to about 2000°F. The current program includes studies of the boiling heat transfer and two-phase flow characteristics, and measurements to determine the latent heat of vaporization, density, specific heat, viscosity, thermal conductivity, and electrical resistivity of the liquid phases of rubidium and cesium. The operating experience with the heat transfer loop is described and results given of the preliminary analysis of the heat transfer and fluid flow data for boiling rubidium. (auth)

34394 (AHSB(S)R-46) FAST FRACTURE IN REACTOR PRESSURE VESSELS. W. H. Irvine (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch, Risley, Lancs, England). 1963. 6p.

Revised from AHSB-Memo-38, Jan. 1960.

The mechanism of crack initiation and fast propagation in steel reactor vessels is discussed in the light of experimental and theoretical evidence currently available. It is concluded that such a mode of failure is possible and should be taken into account in assessing the safety of the reactor and fixing the procedures for periodic inspection. (auth)

34395 (ANL-6711) PHASE RELATIONSHIPS IN THE SYSTEM URANIUM OXIDE–LANTHANUM OXIDE. Final Report—Metallurgy Program 9.2.8. D. C. Hill, J. H. Handewerk, and R. J. Beals (Argonne National Lab., Ill.). June 1963. Contract W-31-109-eng-38. 29p.

Urania-lanthana compositions were studied by x-ray diffraction, chemical analysis, and polished-section techniques to determine cubic fluorite solubility, lattice parameter values, stoichiometry, and microstructure. An appreciable variation in fluorite lattice parameter with composition existed for vacuum, hydrogen, and oxidizing heat treatments. The volatility behavior of urania-lanthana solid solutions was investigated by heating for extended time intervals in an oxidizing atmosphere. (auth)

34396 (ASD-TDR-63-245) EVALUATION OF TENSILE DATA FOR BRITTLE MATERIALS OBTAINED WITH GAS BEARING CONCENTRICITY. C. D. Pears (Southern Research Inst., Birmingham, Ala.). May 1963. Contract AF33(657)-7685. 92p. (AD-411813)

Using gas bearings to provide uniaxial loading, the ultimate tensile strengths of an alumina and a graphite were investigated statistically at 70, 1000, and 1600°F and the strengths correlated with volume, surface finish, and strain rate. (auth)

34397 (BBC-119) RESEARCH ON MODIFIED BERYLLIDES AS HIGH-TEMPERATURE NUCLEAR MATERIALS. Quarterly Progress Report, March 1, 1963 through May 31, 1963. R. M. Paine, A. J. Stonehouse, and W. W. Beaver (Brush Beryllium Co., Cleveland). June 30, 1963. Contract AT(33-3)-20. 16p.

Solubility data for nickel in Zr_2Be_{17} at room temperature, 1500, 2000, and 2500°F are presented. Nickel solubility in $ZrBe_{13}$ is too extensive (greater than 20 wt %) to warrant further such studies with this compound. Studies involving titanium solubility, and/or reaction with, $ZrBe_{13}$ and Zr_2Be_{17} indicate that the ternary phase relationships are quite complicated and do not warrant further study. Mechanical test data show that some improvement in high-temperature strength results when compositions are chosen so that all the aluminum is solubilized at these temperatures. The high-temperature (2500–2700°F) oxidation resistance of these materials is comparable to that of unmodified zirconium beryllide. (auth)

34398 (CONF-39-43) EFFECT OF TEST ATMOSPHERE ON STRESS-RUPTURE AND CREEP PROPERTIES OF MOLYBDENUM AT 2200°C. J. B. Conway, P. N. Flagella, D. G. Salyards, and W. L. McCullough (General Electric Co. Advanced Technology Services, Cincinnati). [nd]. Contract [AT 11-1 -171]. 24p. (TM-63-6-3)

From American Nuclear Society Meeting, Salt Lake City, June 1963.

Some stress-rupture and creep properties of molybdenum at 2200°C are presented. Hydrogen and argon atmospheres were used; no atmosphere effect was indicated. The fabrication procedure seemed to have some effect on the strength and grain structure. Data are presented in graphs. (M.C.G.)

34399 (CONF-94-4) STRESS-RUPTURE AND CREEP PROPERTIES OF REFRACTORY METALS TO 2800°C. J. B. Conway, D. G. Salyards, W. L. McCullough, and P. N. Flagella (General Electric Co. Advanced Technology Services, Cincinnati). [nd]. Contract [AT(11-1)-171]. 23p. (TM-63-4-12)

From American Nuclear Society Meeting, Cincinnati, Apr. 1963.

Stress-rupture tests were carried out at 2200 to 2800°C on the following metals and alloys: Mo, Mo–50 wt % Re, Ta, Ta–10 wt % W, W–25 wt % Re, and Re. The effects of atmosphere (hydrogen, argon, and neon) on the test results were studied and found negligible. Elongation-time plots were used to calculate the minimum creep rate as a function of initial stress. (D.L.C.)

34400 (CONF-155-1) A NEW METHOD TO DETERMINE VARIOUS FREE ENERGY STATES OF SILVER OXIDE ON SILVER METAL. Bart van't Riet (Virginia. Univ., Charlottesville) and William J. Watt (Washington and Lee Univ., Lexington, Va.). Contract AT(40-1)-2683. 3p.

To be presented at the American Chemical Society Southeastern Regional Meeting, Charlotte, N. C., Nov. 1963.

The solubility of silver oxide on silver metal is not the same as that of the bulk oxide. The differences in solubility were investigated by shaking silver powder in deaerated solutions of various concentrations of ammonia and in buffers of ammonia and ammonium nitrate at a constant temperature of 25°C. These solutions were shaken in an atmosphere of N_2 in a stoppered bottle and in the absence of light. The concentration of silver ion in these solutions was measured potentiometrically and by using tagged silver ions. The NH_3 concentrations were obtained by titration of aliquots of these solutions to the methyl red end point with HCl both before and after shaking. Although several days elapsed between these titrations, the concentration varied less than 1% in all cases. (auth)

34401 (DRI-2112) A STUDY OF THE SYNTHESIS AND PROPERTIES OF TRANSITION METAL HYDRYLS. Quarterly Progress Report No. 4, April 1, 1963 through June 30, 1963. C. B. Magee, R. W. Sullivan, R. J. Bayuzick, and C. Cheng (Denver. Univ. Denver Research Inst.). July 17, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(11-1)-1185. 20p. (EURAEC-801)

A new, high vacuum Sieverts' apparatus was used for making isothermal pressure measurements of hydrogen gas in equilibrium with condensed phases consisting of lithium, rhodium, and hydrogen. High purity iron capsules were used for containing the condensed phases in these experiments.

It was found that with this new apparatus and these new capsules, measured pressures are lower than those recorded previously at the same temperature. This implies that equilibrium had not been achieved in previous experiments. In all equilibrium pressure determinations carried out this past quarter, the starting material was a mixture of Li and Rh in a 4 to 1 molar ratio. Hydrogen was added to (and then, in some cases removed from) this material, and equilibrium pressures recorded as a function of N_H, the gram-atom fraction of hydrogen in the condensed phase. At 700 and 800°C, the equilibrium pressure isotherms from an N_H of 0 to N_H values of about 0.45 show no plateaus. The phase rule interpretation of this behavior is that at these temperatures there is but a single liquid phase in equilibrium with hydrogen gas. Studies of the lithium–rhodium binary system were hampered by difficulties in preparing homogeneous alloy specimens. Some evidence indicates the presence of a eutectic in the region of Li-rich alloys melting about one half of a degree centigrade below the melting point of lithium. In the region of rhodium-rich alloys (63 atomic percent Rh), a melting range from 1620 to 1940°C was observed in a single experiment. The evidence still suggests that the intermetallic compound in this system is of composition 50 atomic percent lithium. (auth)

34402 (EUR-357.d) PHYSIKALISCH-THERMISCHE EIGENSCHAFTEN VON Na-, K- UND NaK-LEGIERUNGEN IN TEMPERATURBEREICH ZWISCHEN SIEDEPUNKT UND ETWA 1300°C. (Physico-Thermal Properties of Na-, K- and NaK-Alloys in Temperature Range Between Boiling Point and About 1300°C). K.-H. Spiller (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 66p.

For Na, K, and NaK alloys in their liquid state, in the temperature range between the saturation point and 1300°C, values already known concerning density, specific heat, thermal conductivity, viscosity, surface tension, vapor pressure, and heat of vaporization are given. These cover also the vapor phase, when applicable. These values were examined critically. Graphs of the most likely values plotted against temperature were made as well as a Mollier diagram of Na. Data concerning melting heats and corrosion are included. (auth)

34403 (GEAP-4192) HYDROGEN OVERVOLTAGE AND ELECTROCHEMICAL POTENTIALS OF ZIRCONIUM AND ZIRCONIUM INTERMETALLICS. J. S. Armijo (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Mar. 1, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(04-3)-189. (EURAEC-620). 32p.

Hydrogen overvoltage measurements of Zr, Zr_2Ni, Zr_2Cu, ZrV_2, and Zr–90 wt % Nb were made in 1M H_2SO_4 over a large current density range. Electrochemical potentials as a function of time were measured for the following galvanic cells: Zr–Zr_2Ni, Zr–Zr_2Cu, Zr–ZrV_2, Zr–$ZrFe_2$, Zr–$ZrCr_2$, and Zr–(Zr–90 wt % Nb). A relationship linking hydrogen overvoltage and hydrogen pickup is presented which is based on a relationship between hydrogen overvoltage and the heat of adsorption of atomic hydrogen. This relationship is compared with known hydrogen pickup data and the present electrochemical measurements. (auth)

34404 (IITRI-B6005-8) RESEARCH DESIGNED TO EVALUATE Zr–2.5Nb AND Zr–2.5Nb–0.5Cu ALLOYS FOR DELAYED FAILURE HYDRIDE SUSCEPTIBILITY. Quarterly Report No. 3, April 15, 1963–July 14, 1963. D. Weinstein and F. C. Holtz (Illinois Inst. of Tech., Chicago. IIT Research Inst.). July 8, 1963. Contract AT(11-1)-578. 12p.

A program is in progress to determine the extent to which Zr–2.5Nb and Zr–2.5Nb–0.5Cu exhibit delayed failure under various conditions of hydrogen content, heat treatment, ambient temperature, and specimen geometry. Specimens are hydrogenated to 200 or 500 ppm in a modified Sieverts apparatus, heat treated or cold reduced (150°C), and then evaluated in dynamic tensile and delayed failure tests. Data presented on the ternary alloy show that the beta-quenched and aged condition promotes a high sensitivity to static fatigue fracture. At room temperature, unnotched specimens containing 500 ppm hydrogen showed ordinary dynamic tensile stress-strain properties with very good values of strength and elongation. However, at an applied stress of 95% of the yield stress, static fracture—in the absence of macroscopic plastic deformation—occurred after several hundred hours. Photomicrographs are presented showing the brittle crack propagation through the microstructure; mechanisms for such behavior are still speculative, however. (auth)

34405 (IS-576) THE WORK HARDENING OF AMES THORIUM. D. E. Williams and W. L. Larsen (Ames Lab., Ames, Iowa). July 1963. Contract W-7405-eng-82. 18p.

The work hardening characteristics of Ames thorium are described in terms of Vickers and Rockwell-E hardness measurements made on cold rolled and cold swaged specimens. The Vickers work hardening curves obtained from both types of deformation were found to increase rapidly up to approximately 10% reduction, then remain relatively flat throughout a large intermediate range. Above about 60% reduction, the hardness was again observed to rise more rapidly. The Rockwell-E work hardening curves of specimens deformed by cold rolling were similar to the Vickers curves in the early and intermediate stages. However, the final portions of the Rockwell-E curves were more flat than those produced by Vickers measurements. The Rockwell-E work hardening data from cold swaged specimens were in closer agreement with those for cold rolled specimens after the data from the swaging experiments were corrected for error introduced by the cylindrical shape of the specimens. (auth)

34406 (MSAR-63-117) EFFECT OF 1200°F SODIUM ON AUSTENITIC AND FERRITIC STEELS. PHYSICAL PROPERTIES OF MATERIALS. Progress Report 35. (MSA Research Corp., Callery, Penna.). Aug. 15, 1963. Contract AT(11-1)-765. 23p.

The effects of air, helium, and sodium on the creep-rupture properties of chromium-molybdenum carbon steel and type 316 stainless steel at 1100 and 1200°F, respectively, are shown. (N.W.R.)

34407 (NAA-SR-6761) DIFFUSION OF FISSION GAS IN URANIUM. J. W. Savage (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Aug. 15, 1963. Contract AT(11-1)-Gen-8. 34p.

The diffusion coefficient and activation energy for diffusion of xenon-133 in uranium metal have been determined for a number of varying sample conditions, with metal of high purity and commercial purity. Thin foil samples were neutron irradiated, in groups, under conditions such as to produce optimum uniformity of fission product concentration throughout the samples. The samples were irradiated to burnups in the approximate range of 10^{14} to 10^{17} fissions/cc at ambient temperatures in the GETR shuttle tube. After suitable time periods to permit decay of interfering radioisotopes and to facilitate handling, the samples were annealed at temperatures in the range 600 to 1000°C in evacuated static systems. The xenon-133 (5.7 day halflife) released was measured in situ by scintil-

lation counting of the 81 kev gamma emission. A dependence of gas released upon initial gas concentration was observed. A possible dependence upon the metallurgical condition of the material was also determined. The work is discussed in its relation to other work in the field. The effect of internal precipitation upon external release measurements is described. (auth)

34408 (NAA-SR-7921) DECARBURIZATION OF CAST URANIUM CARBIDE BY HEATING IN HYDROGEN. W. G. Smiley and W. D. Turner (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Aug. 15, 1963. Contract AT-11-1-GEN-8. 23p.

The removal of excess carbon from cast UC by heating in hydrogen at 1600 to 2000°C was studied by means of a thermobalance with a tantalum tube furnace. At temperatures above 1800°C, decarburization automatically stops at the stoichiometric carbon content, because evaporation of uranium maintains constant composition. The rate of carbon removal is diffusion controlled. The diffusivity is a function of composition, increasing rapidly as the stoichiometric point is approached. In the range of carbon content from 4.95 to 5.30 wt %, the diffusivity is given by: $\log D = -1.25 - 10273/T \pm 0.08$. The activation energy is 47 kcal. This agrees with carbon-14 measurements, but the diffusivity is larger than the self-diffusion coefficient by about a factor of seven. This may result from an increase in diffusivity on annealing, or it may be due to the fact that the U–C system is far from an ideal solution. (auth)

34409 (NMI-1253) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. HIGH TEMPERATURE PROPERTIES OF REFRACTORY ALLOYS. Summary Technical Report, July 1, 1961 through June 30, 1962. E. J. Rapperport and A. L. Geary (Nuclear Metals, Inc., West Concord, Mass.). May 20, 1963. Contract AT(30-1)-2784. 78p.

Results of the first year's efforts are described for a program to develop alloys based upon the four major refractory metals, molybdenum, tungsten, niobium, and tantalum, for high-temperature reactor applications. High-temperature properties of ten alloy systems involving metals of the second and third long transition series of the Periodic Table were investigated by means of hot-hardness and oxidation tests. Ruthenium, osmium, and rhenium were found to have the greatest effect upon hardness. Additions of these elements increased the room temperature hardness by up to 7 times and elevated temperature hardnesses up to 17 times, compared with hardness of the unalloyed base metal. However, none of the alloying elements investigated significantly improved oxidation resistance. Alloy compositions selected on the basis of the hot-hardness test results were arc-cast into 2-inch diameter ingots, extruded into rods, and their mechanical properties at temperature up to 1800°C studied in more detail. Among the alloys investigated, Nb–Re, Ta–Ru, and W–Ru appear to offer the most promise for further development. (auth)

34410 (NP-13057) DISPERSION STRENGTHENED NICKEL-BASE ALLOYS. Progress Report No. 2, May 1 to June 30, 1963. A. S. Bufferd, R. C. Nelson, and N. J. Grant (New England Materials Lab., Medford, Mass.). Aug. 1, 1963. Contract N600(19)59891. 12p.

A series of dispersion strengthened Nichrome-thoria alloys prepared by mechanical mixing techniques showed no mechanical property improvement relative to the base composition, Nichrome. Attempts at introducing the dispersion of thoria by decomposition of thorium nitrate onto Nichrome powder have been initiated. (auth)

34411 (ORNL-TM-483) STRUCTURAL ANALYSIS OF ZIRCALOY FUEL-ELEMENT CONTAINERS FOR THE NS SAVANNAH REACTOR. L. R. Shobe (Oak Ridge National Lab., Tenn.). Aug. 19, 1963. Contract W-7405-eng-26. 149p.

Structural evaluations were made of the 15% cold-worked Zircaloy fuel-element containers proposed for the NS Savannah reactor. These evaluations, which are consistent with the Navy Code, permitted the sizing of components so that under conservative loading conditions both stress and deflection limitations would be met. The necessary design modifications were specified for the fuel-element container assembly. (auth)

34412 (ORNL-TM-641) DETERMINATION OF OPTIMUM CONDITIONS FOR ANODIZING ALUMINUM ALLOY 6061. H. L. Holsopple (Oak Ridge National Lab., Tenn.). Aug. 1, 1963. Contract W-7405-eng-26. 20p.

Experiments were conducted to determine optimum conditions for anodizing aluminum alloy 6061. Operating conditions were sought whereby coatings of high density, reasonable durability, and high electrical insulating characteristics would be produced on the alloy. The major variables that affect the formation, dissolution, and physical properties of an oxide film were, therefore, studied. These variables include the temperature and concentration of the electrolyte, anodizing time, and current density. Experimental results are summarized and recommended anodizing procedures are given. (auth)

34413 (TID-19109) OBSERVATIONS CONCERNING THE INTERDIFFUSION OF Cb-1 Zr ALLOY WITH TYPE 316 STAINLESS STEEL. A. V. Manzione, F. J. Huegel, and D. E. Fornwalt (Pratt and Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.). [nd]. Contract AT (30-1)-2789. 19p.

The interdiffusion of co-extruded Nb–1Zr alloy–Type 316 stainless steel diffusion couples heat treated at 732, 871, 982, and 1093°C for periods of 115, 400, 900, and 1400 hr is discussed. Techniques used in the study consisted of optical and electron metallography, x-ray and electron diffraction, and electron microbeam probe analyses. Results demonstrated that the couple forms a NbC diffusion barrier showing stability to temperatures up to 760°C for time periods up to 9300 hr. This barrier was disrupted to allow interdiffusion of Fe, Ni, Cr, and Nb to form intermetallic compounds. (M.C.G.)

34414 (TID-19229) NOBLE GAS SOLUBILITY AND DIFFUSION IN UO_2. Period covered: September 1, 1962 through June 30, 1963. S. Hasko and R. Szwarc (National Bureau of Standards, Washington, D. C.). Aug. 6, 1963. Contract AT(49-2)-1165. 8p.

The solubility of helium in powdered Norton (fused) and Amelinckx (single crystal) uranium dioxide was determined at 800°C and 110 atmospheres as a function of time. The solubility of helium in the fused UO_2 is 0.06×10^{-6} g He/g UO_2 and in the single crystal UO_2 is 0.01×10^{-6} g He/g UO_2. Techniques to introduce helium into single crystals are being developed. (auth)

34415 (UCRL-6187(Rev.)) ENGINEERING TESTING OF THE F-48 COLUMBIUM ALLOY. John W. Cox and Richard W. Werner (California. Univ., Livermore. Lawrence Radiation Lab.). Aug. 2, 1961. Contract W-7405-eng-48. 64p.

The F-48 Nb-base alloy maintains useful mechanical properties for structural application up to 2600°F. Short-time tensile and creep rupture strengths were determined for four F-48 plates, each from a different heat and with a different work history. Flow testing in a high-temperature,

high-pressure air stream was conducted to study oxidation behavior of the bare metal. Auto-ignition is found to occur at a stream temperature of 2600°F. The phenomenon appears to be temperature dependent only. Development of an oxidation protection coating, utilizing environmental flow test apparatus, is proceeding. (auth)

34416 (UCRL-7326(Rev.I)) DETERMINATION OF DYNAMIC MODULUS AT HIGH TEMPERATURES BY THE USE OF ULTRASONICS. H. L. Dunegan (California. Univ., Livermore. Lawrence Radiation Lab.). July 18, 1963. Contract W-7405-eng-48. 29p. (CONF-59-4)

From the American Society for Metals Western Metal Congress, Los Angeles, Mar. 1963.

A technique for measuring velocity of ultrasonic waves in isotropic solids at temperatures to 1600°F is presented. The specimen design allows both longitudinal and shear velocity data to be obtained with one transducer by virtue of using a mode conversion principle. The theory, specimen preparation, instrumentation, and experimental procedure are described along with some experimental results of the variation of Young's modulus, shear modulus, and Poisson's ratio in hafnium, 4340, and Hastelloy "C" to temperatures of 1600°F. (auth)

34417 (UCRL-7430) THERMAL STRESS FRACTURE CHARACTERISTICS OF BeO. William M. Wells and Carl F. Cline (California. Univ., Livermore. Lawrence Radiation Lab.). July 15, 1963. Contract W-7405-eng-48. 27p. (CONF-102-3)

To be presented at the American Society of Mechanical Engineers Meeting, Philadelphia, Nov. 1963.

Extensive experimental results on the thermal stress resistance of BeO were obtained in the temperature range of 1800 to 2800°F. During the tests, the specimen was maintained at a constant mean temperature. (auth)

34418 (UCRL-10816) RECOVERY OF INTERNALLY OXIDIZED SILVER–MAGNESIUM ALLOYS (thesis). R. Busch (California. Univ., Berkeley. Lawrence Radiation Lab.). June 1963. Contract W-7405-eng-48. 64p.

The low-temperature annealing response of a cold-worked internally oxidized silver–0.1 at. % magnesium alloy was investigated and compared with the annealing behavior exhibited by the corresponding solid solution alloy and by pure silver. Wire specimens were deformed in tension at 78°K, and the recovery was followed by measurement of the electrical resistivity and flow stress at 78°K after suitable isochronal and isothermal anneals at temperatures between 78 and 550°K. It was found that both point-defect and dislocation annealing processes are markedly retarded by the presence of the finely dispersed Mg–O clusters introduced by internal oxidation. The effect of the dispersed phase on the annealing behavior is broadly explained in terms of defect cluster interactions. It is suggested that point defect annealing is inhibited because vacancies and/or interstitials generated during plastic deformation are trapped in the strain fields surrounding these clusters. The dispersion provides obstacles to the climb and glide of dislocations and also acts to restrain the motion of grain and subgrain boundaries, thereby retarding the rearrangement and annihilation of dislocations on annealing. Based on the changes in various physical properties produced by internal oxidation, and evidence obtained from other sources, a model for the structure of the dispersed phase alloy is proposed. The model assumes that coherent clusters or zones of magnesium and oxygen atoms less than 30 Å in diameter are formed in the silver matrix during internal oxidation. (auth)

34419 (WADC-TR-57-344(Pt.VII)) DEVELOPMENT OF COLUMBIUM-BASE ALLOYS. Richard T. Begley, R. William Buckman, John L. Godshall, and Roland Stickler (Westinghouse Electric Corp. Astronuclear Lab., Pittsburgh and Westinghouse Electric Corp. Research Labs., Pittsburgh). Apr. 1, 1963. Contract AF33(616)-6258. 93p.

The influence of carbon additions on the properties of a complex columbium alloy, Cb–10W–5V–1Zr (B-77), was investigated. Carbon additions of 0.077 and 0.15 wt % refined the as-cast grain size and increased hardness. For the conditions of heat treatment investigated, the carbon level had no effect on the 1205°C (2200°F) stress rupture strength of B-77, but the carbon-containing alloys had higher rupture strains than low-carbon B-77. Heat treatment studies did not show any evidence of precipitation hardening effects; however, solution-annealed and cold-rolled B-77 + 0.15 C material gave significantly higher hot hardness values than solution annealed material, suggesting that carbide precipitation on dislocations was contributing to high-temperature strength. Preliminary data showed grain boundary sliding occurred in B-77 during creep testing at 1205°C (2200°F). The Cb-rich corner of the Cb–V–Mo ternary system was studied by means of metallography, lattice parameter measurements, and melting point determinations. The system was single phase under all conditions of heat treatment. Classical precipitation hardening behavior was exhibited by Cb–Hf–N and Cb–W–Hf–N alloys. The precipitation of HfN constituted the hardening mechanism in these alloys. The effect of heat treatment in high temperature strength was evaluated by means of hot hardness measurements. The hot hardness values for these alloys were much superior to those of B-66 at temperatures up to 1315°C (2400°F). (auth)

34420 (WANL-PR-M-004) PILOT PRODUCTION AND EVALUATION OF TANTALUM ALLOY SHEET. Summary Phase Report, April 15, 1962 to March 15, 1963. R. L. Ammon and R. T. Begley (Westinghouse Electric Corp. Astronuclear Lab., Pittsburgh). June 15, 1963. Contract NOw-62-0656-d. 91p. (AD-409896)

Studies of the processing and properties of tantalum-rich alloys in the Ta–W–Hf system were carried out. Procedures for the production of pilot quantities of low interstitial T-111 (Ta–8W–2Hf) sheet from 3-in. diameter ingots were developed, and detailed evaluations of mechanical and physical properties were conducted. The effects of intentional additions of interstitial elements, carbon, oxygen, and nitrogen, on fabricability, weldability, and mechanical properties of T-111 were investigated. Limited amounts of carbon and nitrogen improved mechanical properties while oxygen had little or no effect. Interstitial additions on the order 0.03 wt % had no adverse effect on fabricability or weldability. The determination of the optimum composition of T-111 with respect to the substitutional solutes, tungsten and hafnium, consistent with good fabricability, weldability, and high temperature strength is described. Results indicated that a minimum in weld bend transition temperature occurs at a tungsten–hafnium ratio of 4 : 1, permitting the total solute concentration of T-111 to be raised to 14 wt % without adversely affecting the fabricability and weldability, while resulting in a significant increase in the high temperature tensile properties. Limited studies of the weldability and mechanical properties of Ta–W–Re, Ta–W–Hf–V, and Ta–W–Hf–Re alloys were also carried out. (auth)

34421 (AEC-tr-5964) DEFORMATION AND DISCONTINUOUS PRECIPITATION. I. EFFECT OF DEFOR-

MATION ON THE KINETICS OF PRECIPITATION AND CHANGES IN PRECIPITATION BEHAVIOR. Horst Boehm. Translated for Los Alamos Scientific Lab., N. Mex. from Z. Metallk., 54: 142-6(Mar. 1963). 19p.

The effect of deformation on the kinetics of discontinuous precipitation and on changes in precipitation behavior is reviewed. Nucleation is always promoted by deformation. However, the results obtained to date on the effect of deformation on the growth rate of precipitation cells are not as unambiguous. The manner in which the individual factors controlling the growth of precipitation cells can be altered by a deformation is discussed. Accurate investigations of a copper-magnesium and a copper-indium alloy showed that deformations up to 30% do not alter the growth rate of cells. A deformation carried out prior to precipitation can also lead to partial or complete suppression of discontinuous precipitation and cause continuous precipitation instead. It is shown that such a change in precipitation behavior may be due to the effect of deformation on nucleation as well as on the growth process. (auth)

34422 AN X-RAY AND NEUTRON-DIFFRACTION INVESTIGATION OF THE MAGNETIC PHASE $Al_{0.89}Mn_{1.11}$. P. B. Braun (Philips' Gloeilampenfabrieken, Eindhoven, Netherlands) and J. A. Goedkoop. Acta Cryst., 16: 737-40 (Aug. 10, 1963). (In English)

X-ray- and neutron-powder-diffraction data show that $Al_{0.89}Mn_{1.11}$ is tetragonal, a = 2.77, c = 3.54 Å, with $Al_{0.03}Mn_{0.97}$ at (0,0,0) and $Al_{0.86}Mn_{0.14}$ at ($\frac{1}{2}$,$\frac{1}{2}$,$\frac{1}{2}$). The manganese magnetic moments of 1.94 Bohr magnetons are along the c-axis, pointing in opposite directions for the two positions. By mechanical deformation the disorder may be increased. These results are shown to be compatible with measured values of the saturation magnetization. (auth)

34423 THE CRYSTAL STRUCTURE OF YCu_2. Prabhat K. Kerjriwal and Earle Ryba (Pennsylvania State Univ., University Park). Acta Cryst., 16: 853(Aug. 10, 1963).

An independent determination of the structure of YCu_2 is given by single-crystal techniques. CuKα radiation was used in powder and single-crystal methods. The lattice constants found were a = 4.308 ± 0.003, b = 6.891 ± 0.008, and c = 7.303 ± 0.007 Å. Other structure factors and parameters are tabulated. (R.E.U.)

34424 ADVANCES IN X-RAY ANALYSIS. VOLUME 6. Proceedings of the Eleventh Annual Conference on Application of X-Ray Analysis held August 8-10, 1962. William M. Mueller and Marie Fay, eds. Advan. X-Ray Anal., 6: 1-480(1963). New York, Plenum Press, 1963. $17.50.

Forty-four papers are included: separate abstracts were prepared for 7; 4 articles on the use of a modified radial distribution analysis for indexing powder patterns, diffraction effects from irradiated Al single crystals, structure of the alkaline earth oxide cathode, and applicability of routine methods of crystallite size analysis were previously abstracted in NSA. The remaining 33 articles include information on applications, characteristics, and results of powder diffraction patterns, x-ray diffraction analysis, crystal structures of crystals and alloys, x-ray spectrography, and x-ray fluorescence analysis, and a high temperature x-ray diffractometer furnace utilizing high frequency heating. (P.C.H.)

34425 THE ZIRCONIUM–IRON SYSTEM. F. N. Rhines and R. W. Gould (Univ. of Florida, Gainesville). Advan. X-Ray Anal., 6: 62-73(1963).

By means of a combined x-ray diffraction and metallographic study, two heretofore unrecognized phases, Zr_4Fe and Zr_2Fe, were identified. Approximate verification of this finding was made using microprobe analysis. A tentative revision of the Zr–Fe phase diagram is proposed. (auth)

34426 THE CRYSTAL STRUCTURE OF $ThPd_4$. J. R. Thomson (Imperial Coll. of Science and Tech., London). Advan. X-Ray Anal., 6: 91-5(1963).

The structure of $ThPd_4$ was determined by x-ray powder methods. It has the simple cubic Cu_3Au ($L1_2$) structure a = 4.110 ± 0.002 Å at 80 at. % Pd. Interatomic distances and the range of stability of the compound and of $ThPd_3$ are discussed briefly. (auth)

34427 X-RAY MEASUREMENT OF THE STATIC LATTICE DISTORTION IN THE SOLID SOLUTION OF OXYGEN IN TITANIUM. F. R. L. Schoening and F. Witt (Franklin Inst., Philadelphia). Advan. X-Ray Anal., 6: 136-41(1963).

Oxygen was introduced into a single crystal of Ti in successive stages. The intensities of the h00 and 00l reflections were measured with a single-crystal diffractometer. The observed variation of the intensities with O concentration was attributed to three factors: additional scattering from the O atoms; a change in the Debye–Waller factor; and an exponential factor originating from the distortion around the O atom. The theory of x-ray scattering from crystals containing centers of distortion was applied to the hexagonal Ti containing interstitial O atoms. Using the variation of the lattice constant with O concentration, it was possible to predict the intensity reduction due to lattice strains. It was concluded that it would have been possible to obtain an estimate of the defect concentration from the x-ray measurements of lattice expansion and intensity reduction. (auth)

34428 PRECISION X-RAY DIFFRACTOMETRY USING POWDER SPECIMENS. L. F. Vassamillet (Mellon Inst., Pittsburgh) and H. W. King. Advan. X-Ray Anal., 6: 142-57(1963). (TID-16454)

Errors concerned with the geometry of the counter tube diffractometer method, the nature of the x-ray source, and the technique of collecting data are reviewed briefly. Errors arising from imperfections in the instrument and misalignment of the x-ray source with respect to the diffractometer were studied experimentally. The results are presented and discussed in terms of the resultant error in the determination of the lattice parameter of a cubic crystal. Errors determined both analytically and empirically are discussed in relation to the extrapolation procedures commonly used for diffractometers. It is shown that, depending on the construction of the instrument, the effect of imperfections in the gears may almost double the error in the final extrapolated value of a lattice parameter. (P.C.H.)

34429 AN X-RAY DETERMINATION OF THE DEBYE-WALLER FACTORS FOR Cu_2O AND UO_2 AND THE ATOMIC SCATTERING FACTOR FOR Cu IN Cu_2O. C. J. Sparks, Jr. and B. S. Borie (Oak Ridge National Lab., Tenn.). Advan. X-Ray Anal., 6: 177-84(1963).

The Debye–Waller factor for Cu_2O and the atomic scattering factor for Cu were determined independently of each other at one temperature from measurements of both the diffuse scattering and the integrated intensities of the Bragg maxima. The scattering factor agreed well with that computed from theory. The characteristic temperature computed from the Debye–Waller factor at 298°K was found to be 182°K. At 88°K its value is 152°K. Similar measurements of the Bragg maxima with a powder sample of UO_2 were not useful because of preferred orientation. However, the diffuse intensity is not so sensitive to preferred orientation and may be used to determine the characteristic

temperature. Its value for UO_2 was found to be 188°K at room temperature. (auth)

34430 MEASUREMENT OF THE LATTICE CONSTANTS OF NEON ISOTOPES IN THE TEMPERATURE RANGE 4-24°K. L. H. Bolz and F. A. Mauer (National Bureau of Standards, Washington, D. C.). Advan. X-Ray Anal., 6: 242-9(1963).

Using an x-ray diffractometer cryostat, the lattice constants of the isotopes Ne^{20} and Ne^{22} as well as the naturally occurring mixture (Ne^n) were measured throughout most of the temperature range in which they exist as solids (0 to approximately 24°K). The heavier isotope has the smaller lattice constant, the values obtained at 4.2°K being: Ne^{20} = 4.462, Ne^{22} = 4.454, and Ne^n = 4.462 Å. The absolute error in the values is believed to be no greater than 0.001 Å. The volume expansion coefficient, which does not appear to differ significantly in the three cases, increases to a value of 6.3×10^{-3}/°K at 24°K. (auth)

34431 X-RAY SPECTROGRAPHIC ANALYSIS OF RARE EARTHS IN YTTRIUM–IRON GARNET POWDERS. J. C. Lloyd and J. D. Kuptsis (International Business Machines Corp., Yorktown Heights, N. Y.). Advan. X-Ray Anal., 6: 389-95(1963).

Analysis schemes for eleven rare earths (Ce, Pr, Nd, Sm, Eu, Tb, Dy, Ho, Er, Tm, Yb) taken singly in Y–Fe garnet powders are presented. Straight-line calibrations result in all cases, usually over a range from below 0.5 wt % to better than 6 wt %. Errors were held to ± 5 to 10% even using extraordinarily simple sample preparation techniques. Data are presented relating to the effects of particle size and sample preparation on precision and accuracy of the resulting analysis. (auth)

34432 CERAMIC MATERIALS IN REACTOR CONSTRUCTION. Angew. Chem., 75: 249(Mar. 7, 1963). (In German)

34433 RADIOGRAPHY WITH COBALT-60 AND ELECTRON LINEAR ACCELERATOR. Junichiro Furuta, Eiichi Hiraoka, Shinichi Okamoto, and Yukio Tsujii. Ann. Rept. Radiation Center Osaka Prefect., 3: 86-9(1962). (In English)

Data on the radiography of steel using both Co^{60} and an electron linear accelerator are reported. A comparison was made of exposure times for both methods. (P.C.H.)

34434 TRANSMISSION ELECTRON MICROSCOPY OF SINGLE CRYSTALS OF CERAMIC MATERIALS. H. Blank (Euratom, Mol, Belg.). Ber. Deut. Keram. Ges., 40: 136-9(1963). (EUR 164.d). (In German)

The methods of investigating lattices in crystals were largely developed on metals. In most cases, however, they can be equally used with nonmetals. After a brief description of transmission electron microscopy and the preparation methods involved, some results on irradiated and unirradiated UO_2 are reported. (auth)

34435 R & D PAYS OFF FOR U. S. COMPANY. AECL PROJECT PART 4. Ian Morris. Can. Metalworking, 26: No. 3, 37(Mar. 1963).

Zircaloy-2 is forged and hot extruded in the fabrication of coolant tubes and other reactor hardware. Low neutron absorption, nuclear fission efficiency, elevated temperature mechanical properties, and superior corrosion resistance indicate adaptability of the material for reactor applications. (Rev. Metal Lit., 20: No. 6, June 1963)

34436 THE SPECIFIC HEAT OF URANIUM MONOCARBIDE AT LOW TEMPERATURE. André de Combarieu, Paul Costa, and Jean-Claude Michel (Centres d'Études Nucléaires, Grenoble and Fontenay-aux-Roses, France). Compt. Rend., 256: 5518-21(June 24, 1963). (In French)

The specific heat of a sample of uranium monocarbide was measured between 1.5 and 4.2 and 20 and 85°K. The γ coefficient of the electron specific heat and the Debye temperature Θ_D of the lattice were determined. These measurements permitted the electron structure of uranium monocarbide to be defined. (tr-auth)

34437 STUDY OF THE RESISTIVITY OF SAMPLES OF BERYLLIUM OF DIFFERENT PURITY AS A FUNCTION OF THE TEMPERATURE AND DETERMINATION OF THE DEBYE TEMPERATURE OF THIS METAL. Robert Reich, Vu Quang Kinh, and Jacques Bonmarin (CNRS, Vitry-sur-Seine, France). Compt. Rend., 256: 5558-61(June 24, 1963). (In French)

After a determination of the optimum conditions for the anneal of Be samples of different purity, the variation of the electrical resistivity was measured between 2 and 500°K. It was shown that the ideal resistivity changes with the degree of purity and varies as a function of the temperature according to powers of the temperature from 4 to 1.5 at temperatures from 55 to 500°K in the case of the purest metal. A Debye temperature of 1240°K was found. (tr-auth)

34438 SUPERCONDUCTING MAGNETIC COILS. Eugen Saur. Elektrotech. Z., 14: 705-8(Dec. 24, 1962). (In German)

Superconductive properties with emphasis on magnetic field strength-temperature relationships and production technology of superconductive alloys including 3Nb–Zr, 2Nb–ti, 2Mo–Re, and Rb–Bi are given. The use of superconductive coils for the production of very strong magnetic fields is discussed. (Rev. Metal Lit., 20: No. 4, April 1963)

34439 SINTERED BERYLLIA. Eugene Ryshkewitch. Interceram (Luebeck, Ger.), No. 2, 74-81(1962).

A review is presented on the mechanical, structural, electric, and optical properties of single and polycrystal BeO; phase diagrams of BeO with Al_2O_3, SiO_2, and UO_2; properties of ceramic materials of BeO in combination with MgO, Al_2O_3, and ZrO_2, elastic and strength properties of the ceramics, thermal data, and electrical applications. (Rev. Metal Lit., 20: No. 4, April 1963)

34440 DIFFUSION PROCESSES IN LEAD–URANIUM SYSTEMS. G. J. Wasserburg (California Inst. of Tech., Pasadena). J. Geophys. Res., 68: 4823-46(Aug. 15, 1963).

The ratio r_λ of radiogenic daughter to residual parent (with decay constant λ) was investigated for a continuous diffusion model for a diffusion coefficient that is an arbitrary function of time. A solution for simultaneous diffusion of both parent and daughter is given in closed form. A theory is also developed that describes the trajectories r_λ, $r_{\lambda'}$ for paired decay schemes (with decay constants λ and λ') in the neighborhood of concordia. A wide class of systems is shown to be linear in the r_λ, $r_{\lambda'}$ diagram when $\int_0^\tau D(\eta)\, d\eta/a^2 \ll 1$. A radiation damage model is proposed for the diffusion coefficient that relates $D(\tau)$ to the integrated irradiation damage and to the U (and Th) contents. The functional relation between r_λ and the U content is found for three important cases. The model $D(\tau) = D_1\tau$ yields a r_λ, $r_{\lambda'}$ curve that is very similar to that obtained by Tilton for $D = D_0$. The slope is somewhat greater and the linear region more extended. The theoretical curves are found to be in reasonable agreement with the existing experimental data, and they fit the existing data at least as well as the constant D model. (auth)

34441 THERMAL DIFFUSION IN THE HIGH TEMPERATURE PHASES OF ZIRCONIUM AND TITANIUM. H. G. Feller and H. Wever (Technische Universität, Berlin). J. Phys. Chem. Solids, 24: 969-73(July 1963). (In German)

Transport phenomena were investigated in Ti and Zr tubes with an outside diameter of 5 mm, an inside diameter of 3 mm, and a length of 50 mm. The samples were clamped between cooled copper jaws and charged with an a-c voltage of 50 Hz under a vacuum of $<10^{-5}$ Torr. The samples were heated to 950°C, held there for 48 or 72 hrs, and then cooled at a rate of 10°/min. The transformation temperature of Ti was determined to be 882° and of Zr, 862°C. In both metals the crystal structure was hexagonal below the transformation temperature and face-centered cubic above the transformation temperature. The temperature pattern and the variations of distance between marked points in both Ti and Zr were determined as a function of position coordinates. The reasons for the differences between the experimental and theoretical curves are discussed. The results show that the transport heat of Zr is positive in the high-temperature phase and that of Ti is negative. (J.S.R.)

34442 NEUTRON DIFFRACTION STUDY OF THE INTERMETALLIC COMPOUND FeSi. Hiroshi Watanabe (Atomic Energy of Canada Ltd., Chalk River, Ont.), Hisao Yamamoto, and Ken-ichi Ito. J. Phys. Soc. Japan, 18: 995-9(July 1963).

A powder neutron diffraction study was made on the intermetallic compound, FeSi. From magnetic measurements this substance was believed to be antiferromagnetic below 170°C. Neutron diffraction measurements at room temperature and at liquid nitrogen temperature, however, show no coherent antiferromagnetic intensity, thus ruling out any long range magnetic order. Some results of magnetic measurements and discussion are presented. (auth)

34443 ELECTRICAL RESISTIVITY OF DILUTE ALLOYS OF RARE EARTHS WITH YTTRIUM AT LOW TEMPERATURES. Tadashi Sugawara and Ikuyo Yamase (Tokyo Univ.). J. Phys. Soc. Japan, 18: 1101-2(July 1963).

The results of resistivity measurements on dilute solid solutions of Nd, Gd, Tb, and Er with Y are presented. The resistivity of all alloys varied monotonically with temperature and showed an abrupt decrease at low temperatures. Resistivity vs temperature curves are shown. These alloys have antiferromagnetic transitions at low temperatures. The decrease of the resistivity may be attributed to the decrease of the magnetic scattering due to the ordering of the magnetic moment of the rare earths. (C.E.S.)

34444 MAGNETIC PROPERTIES OF DILUTE ALLOYS OF RARE EARTHS WITH YTTRIUM AT LOW TEMPERATURES. Tadashi Sugawara and Ryukichi Soga (Tokyo Univ.). J. Phys. Soc. Japan, 18: 1102-3(July 1963).

Magnetic susceptibility measurements in dilute alloys of Nd, Gd, Tb, and Er with Y at temperatures between 1.5 and 20°K are presented. All the alloys were paramagnetic at liquid hydrogen temperatures and showed sharp transitions to antiferromagnetism at lower temperatures except Y-Er, which must have a transition below 1°K. The Neel points determined from the reciprocal susceptibility vs temperature curves are given. Experimental Curie constants are compared with calculated values for the alloys. (C.E.S.)

34445 MECHANICAL PROPERTIES OF A MAGNESIUM-ALUMINIUM-BERYLLIUM ALLOY USED FOR FUEL ELEMENT CLADDING. Vladimir Barták (State Inst. of Tech., Prague). Jaderna Energie, 9: 220-6(1963). (In Czech.)

Possibilities of using magnesium alloys for fuel element cladding materials are evaluated. The main attention is given measurements of mechanical properties of a Mg-Al-Be alloy and to their evaluation. (auth)

34446 TRANSMISSION ELECTRON MICROSCOPIC INVESTIGATION ON RECRYSTALLIZATION AND PRECIPITATION OF MAGNESIUM AND MAGNESIUM ALLOYS. Yotaro Murakami, Osamu Kawano, and Hideaki Tamura. Mem. Fac. Eng., Kyoto Univ., 24: 411-19(Dec. 1962).

An investigation was made of the aging characteristics, recrystallization phenomena, and effects of plastic deformation after water quenching on the precipitation of Mg-Th alloys containing 1.7-4.0 wt % Th as compared with Mg, Mg-3.2% Zn, and Mg-11.6% Al alloys with electron microscopic observations in thin foils. It was found that thorium retards recovery and recrystallization, which is reflected in the slow precipitation rate of Mg-Th compounds. (Rev. Metal Lit., 20: No. 6, June 1963)

34447 INVESTIGATION OF SUPRACONDUCTIVE Nb_3Sn SPECIMENS. F. Lange. Monatsber. Deut. Akad. Wiss. Berlin, 4: 655-9(1962). (In German)

A thick-walled hollow cylinder of a stoichiometric Nb_3Sn powder mixture was pressure sintered and measurements were made of the frozen-in fields in pulsating magnetic fields at 14.1 to 17.75°K. (Rev. Metal Lit., 20: No. 6, June 1963)

34448 INVESTIGATION OF THE SYSTEM THORIUM-ZIRCONIUM-CARBON. E. Rudy and F. Benesovsky. Monatsh. Chem., 93: 1279-1283(1962). (In German)

X-ray and microscopic analyses were made of pressure-sintered, vacuum-annealed, and arc-melted specimens of Th, Zr, and carbon, covering the entire concentration range of the ternary system. Representation of the evaluated phase equilibria in terms of isothermal sections at 1100 to 1550°C is presented. (Rev. Metal Lit., 20: No. 6, June 1963)

34449 THE CRYSTAL TYPES HfAs AND $HfAs_2$. W. Jeitschko and H. Nowotny. Monatsh. Chem., 93: 1284-7 (1962). (In German)

Hf-As powder specimens containing 20 to 66.6 at. % As were sintered at 1000 C and x-ray measurements were made of the lattice parameters of the former crystal phases. Identification was made of $HfAs_2$, HfAs, and the Hf-rich phase of the probable composition Hf_4As. (TCO)

34450 GROWTH AND NUCLEATION OF THE $\beta \rightarrow \alpha$ TRANSFORMATION IN URANIUM 0.45 PER CENT CHROMIUM ALLOY. A. Bar-Or, P. Wynblatt, and G. Hirsh (Atomic Energy Commission, Tel-Aviv, Israel). Nature, 199: 585-6(Aug. 10, 1963).

Results are reported from measurements of the growth and nucleation rates of α-uranium during the $\beta \rightarrow \alpha$ transformation at various temperatures in U-0.45% Cr alloy. (C.H.)

34451 SUPERCONDUCTIVITY — ITS USES AND POTENTIAL. R. W. Schmitt and W. De Sorbo. Naval Engrs' J., 75: 199-204(Feb. 1963).

A review is presented on the superconducting materials Nb, Nb_3Sn, Nb_3Zr, Mo_3Re, Ta, V, Sn, Pb, and Hg in terms of suitability for particular applications, including coils, solenoids, computers, gyroscopes, and cryotrons. (Rev. Metal Lit., 20: No. 5, May 1963)

34452 INFLUENCE OF IMPURITIES IN STARTING MATERIAL ON PROPERTIES OF REFRACTORIES FROM ZrO_2. N. I. Voronin, V. S. Gorodetskii, and E. I. Khavkina. Ogneupory, No. 1, 30-5(1963). (In Russian)

The effects of Al_2O_3, SiO_2, Fe_2O_3, TiO_2, and P_2O_5 additions ranging from 2 to 5% on compression strength, refractoriness, porosity, relative expansion coefficients, and microstructure of ZrO_2-based refractory brick were investigated. (TCO)

34453 FORMATION AND PROPERTIES OF SOLID SOLUTIONS OF ZrO_2 WITH OXIDES OF RARE-EARTH ELEMENTS. E. L. Leler and A. B. Andreeva. Ogneupory, No. 5, 224-31(1963).

The formation and properties of solid solutions in the systems ZrO_2-CeO_2, $ZrO_2-Y_2O_3$, and $ZrO_2-La_2O_3$ were studied. Specimens were compacted from mixtures of chemically pure oxides (70 to 95 or 20 mol % ZrO_2 and 30 to 5 or 80 mol % of the second oxide) under a pressure of 500 kg/cm^2, and fired at 1400-1700°C. The specimens were subjected to chemical, x-ray and dilatometric analyses, and their ceramic, elastic, electrical, and physical properties were studied. At 1400°C the systems form solid solutions with a cubic structure. The porosity of specimens heated at 1400°C for 6 hrs is 30 to 40%; sintering occurs on heating to 1700-1750°C for 3 hrs. In specimens containing 20 mol % CeO_2, 15 mol % Y_2O_3, or 25 mol % La_2O_3, ZrO_2 is fully stabilized by heating to 1700-1750°C. Addition of CeO_2 or Y_2O_3 lowers the temperature of the polymorphic transformation of ZrO_2. New highly refractive materials can be obtained by firing to 1750°C the solid solutions $ZrO_2-20\%$ CeO_2, $ZrO_2-80\%$ CeO_2, $ZrO_2-15\%$ Y_2O_3, $ZrO_2-80\%$ Y_2O_3, and $ZrO_2-La_2O_3$. Some of the materials have a lower thermal expansion coefficient and higher thermal stability (at 1200°C) than ZrO_2 stabilized with CaO or MgO. The highest thermal and chemical stability is exhibited by $ZrO_2-Y_2O_3$ solid solutions. (OTS)

34454 DIFFUSION IN TITANIUM AND TITANIUM-NIOBIUM ALLOYS. G. B. Gibbs, D. Graham, and D. H. Tomlin (Univ. of Reading, Berks, Eng.). Phil. Mag. (8), 8: 1269-82(Aug. 1963).

Earlier work on tracer diffusion of solutes in β-Ti, which resulted in abnormally low values of activation energy and frequency factor, was extended to higher temperatures. Diffusion coefficients for the solutes Nb, Mo, Cr, Mn, Fe, Co, and Ni were measured over the whole available temperature range from the $\alpha-\beta$ transformation point at 900°C to the melting point of Ti, 1650°C. The resulting Arrhenius plots show curvature in the direction of apparent activation energies and frequency factors increasing with temperature. This is of special interest in view of the abnormalities previously found, and possible interpretations are suggested. It has not proved possible to distinguish conclusively between two important possibilities, the presence of two diffusion mechanisms, or a single mechanism with temperature dependent parameters. Structure sensitive diffusion mechanisms are believed not to account for the observed curvature. Isotope effect experiments with Fe^{55} and Fe^{59} appear to exclude the 4-atom ring diffusion mechanism as a possible basis for explaining the abnormally low activation energies and frequency factors. Experiments on the diffusion of Nb in Ti-Nb alloys have been extended to the whole composition range 0 to 100% Nb, and the activation energy and frequency factor are given as functions of composition. Further work at the Ti-rich end of this system is necessary to resolve certain ambiguities. (auth)

34455 RESISTIVITY VARIATIONS OF TEMPERED URANIUM AT 100 TO 4.2°K. J. C. Jousset and Y. Quere (Centre d'Etudes Nucléaires, Fontenay-aux-Roses, France). Phys. Letters, 5: 238-40(July 15, 1963). (In French)

34456 THE THERMAL CONDUCTANCE OF COPPER-LEAD-COPPER SANDWICHES AT LIQUID HELIUM TEMPERATURES. L. J. Challis and J. D. N. Cheeke (Univ. of Nottingham, Eng.). Phys. Letters, 5: 305-7(Aug. 1, 1963). (In English)

The thermal conductances per unit area for a copper-lead-copper sandwich are presented for the superconducting and normal states. In the normal state the conductances were large and it was only possible to obtain values up to ~2°K. The conductance in the normal state was considerably larger than that in the superconducting state, and a conductance ratio of 105 was observed at 1.35°K. It is suggested that the conductance in the normal state is mainly electronic and in the superconducting state mainly by phonons except when the phonon current is reduced by dislocation scattering. (C.E.S.)

34457 DE HAAS-VAN ALPHEN EFFECT IN ZIRCONIUM. A. C. Thorsen and A. S. Joseph (Atomic International, Canoga Park, Calif.). Phys. Rev., 131: 2078-81 (Sept. 1, 1963).

The de Haas-van Alphen effect was observed in single crystals of zirconium in pulsed magnetic fields up to 190 kilogauss. A rotating-coil device was used to study the periods of the oscillations as a function of magnetic field direction in the (00.1), (10.0), and (1$\bar{1}$.0) planes of the hexagonal crystals. Five separate oscillatory terms were observed with periods ranging in value from 2.0 to 3.4 × 10^{-8} gauss^{-1}. The data, in general, do not agree with the Fermi surface predicted by the nearly free electron model. (auth)

34458 NEUTRON DIFFRACTION IN HEXAGONAL CHROMIUM. G. Albrecht (Universität, Jena, Ger.), F.-D. Doenitz, K. Kleinstueck, and M. Betzl. Phys. Status Solidi, 3: K249-52(1963). (In German)

An attempt was made to explain the structure of the Cr-H system with the help of neutron diffraction. The neutron wavelength amounted to 1.194 Å. The absorption coefficients of the prepared powder were determined as 0.98 cm^{-1} for Cr-H systems and 0.39 cm^{-1} for Cr-D system. The crystal structure was found to be of the anti-NiAs type. (M.C.G.)

34459 PHASE TRANSFORMATIONS OCCURRING IN MOLTEN MATERIALS DURING THE MELTING OF FERROUS ORES CONTAINING FLUORINE AND RARE EARTHS. L. M. Tsylev, A. V. Rudneva, and T. Ya. Malysheva. Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR, No. 11, 3-15(1962). (In Russian)

In view of the industrial importance of melts formed by ferrous ores containing F and rare-earth elements, the phase transformation taking place during the melting of Fe ores, such as hematite, bastnezite, which contains carbonates and fluorides of Ce, Pr, and La, or monazite, which contains La and Ce phosphate. At temperatures between 900 and 1150°C, a broad solid-phase reaction zone was found. A clear correlation could be established between the lowering of the degree of reduction of the Fe oxides and the transition of the material from the solid to the plastic and liquid state. The chief feature of the slag formation of the F- and rare-earth-containing Fe ores, as compared with SiO_2-containing Fe ores, consists in the dissolution of the interaction of Ca, Fe, the Ce group elements, Fe, and SiO_2 which take place simultaneously; this is enhanced by the fact that Ca is present as the low-melting fluoride, rather than as the refractory oxide. The compounds formed directly from the same starting material depend on the bond forces acting between the cations

and anions; complex Ca, Ce fluorides and silicates are crystallized from the melt, while the Fe cations with less affinity toward silicon remain in the melt. The mineral phases present in the slags are represented by fluorite, cuspidin, cephtosil, and celanite. (TTT)

34460 INVESTIGATION OF THE DIFFUSION OF SILICON AND TITANIUM IN NIOBIUM. P. M. Arzhanyi, R. M. Volkova, and D. A. Prokoshkin. Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR, No. 11, 78-82(1962). (In Russian)

The solid-state diffusion of Si and Ti in Nb at various temperatures was used for determining the structure and the composition of the phases formed by the interaction of the diffusing elements with the matrix metal. Metallographic, x-ray diffraction, x-ray spectrographic, and microhardness measurement methods were used for analyzing the various diffusion layers. It was found that saturation of Nb with the 2 other metals results in the formation of a complex diffusion layer. At the temperature range from 900 to 1100°C, a single layer with a microhardness of 1200 kg/mm^2 was obtained; at 1200 to 1300°C, a double layer was formed, the second of which was about 5 to 6 microns thick. The $NbSi_2$ layer formed at the surface contained up to 5% of dissolved Ti; the compound has a hexagonal lattice with the following parameters: a = 4.779 and c = 6.493 kX. Study of the oxidation kinetics of Nb protected by Si and Ti showed that the logarithmic law applies to the process. The energy of activation of the oxidation was found to be 3660 cal/mol. The surface of Nb specimens saturated with the other 2 metals was found to oxidize at 1200°C nearly 1.5 times more slowly than the surface of Nb saturated with only Si. The oxide layer was thin and adhered well to the base. (TTT)

34461 CORRELATION BETWEEN "COMPOSITION–REFRACTORINESS" IN MAGNESIUM-BASED SYSTEMS. M. E. Drits, Z. A. Sviderskaya, L. L. Rokhlin, E. M. Padezhnova, and L. I. Yakovleva. Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR, No. 11, 124-32(1962). (In Russian)

Elements were previously tested for their suitability as alloying additions of Mg; therefore, in view of the interest of deformed and thermally treated alloys as structural material, the relation between the composition of these alloys and their high-temperature resistance was investigated. The binary systems Mg–Al, Mg–Zn, Mg–Mn, Mg–Th, Mg–Ce, Mg–Nd, and Mg–Ca were studied in the temperature range from 150 to 300°C. The specimens were quenched from temperatures as high as 550°C in the case of the Th and Ce alloys after 10 to 24 hour long soakings with 60 to 70°C water. They were stabilized for 100 hours at the test temperature. The relative heat resistance of the specimens was estimated on the basis of tensile strength measurements. The results indicated that the mechanism of the interaction affects greatly the refractory character of the alloys. In systems with elevated and strongly temperature-dependent solubility in the liquid state, the formation of highly alloyed solid solutions was most effective for increasing the refractoriness. Strong interaction processes at the phase boundary and softening of the second phase indicated in most cases a negative effect of the heterogenization in otherwise similar systems. In alloys exhibiting limited solubility in the solid phase, with only a slight temperature dependence of the solubility, the strengthening effect was due to the decomposition of the solution. Th, Nd, and Ca exhibited a strengthening effect. (TTT)

34462 METHOD FOR THE DETERMINATION OF THE BULK DENSITIES OF GRANULAR MATERIALS. J. L. Evans (C. A. Parsons and Co. Ltd., Newcastle upon Tyne, Eng.). Trans. Brit. Ceram. Soc., 62: 281-7(Mar. 1963).

A mercury-displacement method for the determination of the bulk density of granular materials was developed. The method is applicable to spherical particles greater than 100 μ dia and to angular irregular particles greater than 250 μ dia. The difference in behavior appears to be associated with the size of the interstices in aggregates of the particles. (auth)

34463 THE CATHODIC ETCHING OF PLUTONIUM CERAMICS. G. A. Keig and H. R. Haines (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Brit. Ceram. Soc., 62: 363-73(Apr. 1963). (AERE-R-3866)

The etching of stoichiometric plutonium dioxide and of solid solutions with uranium oxide containing more than 30% plutonium oxide proved to be virtually impossible by conventional chemical and electrochemical techniques. The development of an ionic bombardment apparatus for etching plutonium ceramics is described. Details of operation are given, and photomicrograms of plutonium oxide and carbide samples etched in the apparatus are included. (auth)

34464 FORMATION AND STRUCTURE OF THE BERYLLIUM BORIDE Be_4B. H. J. Becher and A. Schafer. Z. Anorg. Allgem. Chem., 318: 305-12(Nov. 1962). (In German)

The beryllium boride, Be_4B, was formed by sintering pressed compacts at 850 to 950°C under inert gas. The crystal structure was determined by Fourier analysis of x-ray data. An atomistic interpretation of the Be_4B structure is discussed. (TCO)

34465 THE MAGNETIC STRUCTURE OF ORDERED ALLOYS OF THE IRON–SILICON SYSTEM. Dietrich Meinhardt and Otto Krisement (Max-Planck-Institut für Eisenforschung, Düsseldorf). Z. Physik, 174: 472-88 (1963). (In German)

The magnetic scattering of thermal neutrons was used for measurement of the magnetic moments of iron atoms of various lattice positions in ordered iron–silicon systems in the region of 10 to 27 at. % silicon. The preparation of a crystalline sample is described and a method for measuring the mosaic structure is given, which make possible the incorporation of the extinction correction. This gave a strongly distinct magnetic moment of iron atoms at the different lattice positions, whose size was almost proportional to the number of the nearest iron neighbors. The influence of the next but one neighbors is however more plainly recognizable. The magnetization of the sample perpendicular to the lattice normal led to measurement results, which can be explained by polarization phenomena. (tr-auth)

34466 CONCERNING THE SUPERCONDUCTIVITY OF Ti AND Zr–Rh ALLOYS. Ch. J. Raub and C. A. Andersen (Univ. of California, La Jolla). Z. Physik, 175: 105-14 (1963). (In German)

Investigations of the superconductivity in the systems of Ti–Rh and Zr–Rh showed the influence of the valence electron concentration. In the hexagonal densely packed α phases as well as in the cubic space-centered β phases of both systems, the transition temperature increased with the valence electron concentration. The hypothetical transition temperature of the Rh–free β-phase of the Ti or Zr is lower than that of the hexagonal α phase. (tr-auth)

34467 NUCLEAR ENGINEERING MATERIALS. F. Thuemmler. Berlin, Akademie-Verlag, 1962. 19p.

An authoritative survey of nuclear engineering materials is presented with particular reference to thermal reactors, in accordance with the present state of reactor development in East Germany. Discussion is included on: fission and breeding materials; structural and cladding materials, moderators, reflectors; and control, safety, and shielding materials. The characteristics of an ideal nuclear fuel are listed. Those discussed are U, Pu, Th, and compounds of the metals. A special category is that of dispersion elements, consisting of a fissionable material dispersed in a non-fissionable matrix. The matrix may be a metal, oxide, carbide, or graphite. The materials of greatest powder metallurgy interest in this class are Be, and sintered Al with about 10% Si content and small amounts of Ni and Ti. Be is discussed in more detail. As moderator and reflector materials, BeO and graphite are of importance, the latter being also used in large quantities as a cladding material. This class consists of strongly neutron-absorbing materials; these are mainly based upon B, Hf, Cd, and rare earth elements. (TCO)

34468 PROCHNOST METALLOKERAMICHESKIKH MATERIALOV I SPLAVOV PRI NORMAL'NYKH I VYSOKIKH TEMPERATURAKH. (Strength of Sintered Materials and Alloys at Room and High Temperatures). G. S. Pisarenko, V. T. Troshchenko, et al. Kiev, Publishing House of the Academy of Sciences, 1962. 276p.

Strength, ductility, and elasticity of prepared materials and alloys are discussed. Physical and mechanical characteristics of high-melting sintered materials are analyzed, and equipment for friability and porosity tests are described. 141 references. (R.V.J.)

34469 ELECTRICAL PROPERTIES OF COMPOUNDS AND ALLOYS OF RARE-EARTH METALS WITH ELEMENTS OF GROUPS V AND VI. F. J. Reid, L. K. Matson, J. F. Miller, and R. C. Himes (Battelle Memorial Inst., Columbus, Ohio). 4p. (CONF-68-3)

From Electrochemical Society, Pittsburgh, Apr. 1963.

The electric properties of rare earth compounds and alloys with As, Sb, Se, and Te are reported. Without exception, samples of Se and Te compounds with normally trivalent Nd, Gd, and Ce having synthetic compositions, MX and M_3X_4, are n-type with free electron concentrations in the range 10^{20} to $10^{22}/cm^3$, and have very low electric resistivities. Room temperature electric properties and thermoelectric data are tabulated. (P.C.H.)

34470 BERYLLIUM, ITS PROBLEMS AND POTENTIALITY AS A STRUCTURAL MATERIAL. S. H. Gelles, V. Nerses, and J. M. Siergiej (Nuclear Metals, Inc., West Concord, Mass.). 28p. (CONF-53-4; NMI-TJ-51)

From World Metal Show, New York, Nov. 1962.

The brittleness of Be limits its use as a structural material. Research showing that the brittleness can be decreased by controlling grain size and texture is discussed, and work on the improvement of Be ductility by alloying and purification is reviewed. It is shown that several techniques are suitable for fabricating Be into satisfactory complex structures, and applications for which Be is particularly suitable are pointed out. (D.C.W.)

34471 A METAL FIBER-CERAMIC COMPOSITE FOR HIGH TEMPERATURE USE. J. R. Tinklepaugh (Alfred Univ., New York). 10p. (CONF-53-3)

From World Metal Show, New York, Nov. 1962.

It was found that Sr zirconate has very unusual stress-strain properties in that when it is stressed, even at room temperature, it deforms nonelastically. When Sr zirconate is reinforced by Mo fibers, the composite acts as if it had some degree of ductility with a marked degree of nonelastic deformation. (auth)

34472 PHYSICAL PROPERTIES OF ORGANIC NUCLEAR REACTOR COOLANTS. S. Elberg (CEN, Grenoble, France) and G. Friz. 43p. (CONF-14-32)

From American Chemical Society 144th National Meeting, Los Angeles, Mar. 1963.

Diphenyl and terphenyls with different high-boiler content were studied up to temperatures of 450°C. Data from high boiler reactors show viscosity (strong influence), thermal conductivity (medium influence), density and specific heat (small influence). The vapor pressure is in the most affected property (important influence of low boilers). Also viscosity shows an effect. Some data for pure high-boilers are also presented. New results were obtained with direct measurements of the latent heat of vaporization. (P.C.H.)

34473 STRUCTURAL PROPERTIES OF PYROLYTIC CARBONS DEPOSITED BETWEEN 1100 AND 1800°C. C. David (Institut Battelle, Geneva), P. Sublet, A. Auriol, and J. Rappeneau. 39p. (CONF-73-8) (In French)

From 6th Biennial Conference on Carbon, Pittsburgh, June 1963.

The apparent density, microstructure, and preferred orientation of pyrolytic carbons deposited between 1100 and 1800°C were studied. The results obtained led to a classification of the materials into four categories. A particular observation technique by electron microscopy of the first layer deposited made it possible to exhibit the origin of the cones. Deposit-construction mechanisms qualitatively accounting for the whole of the observations are proposed. (auth)

34474 DEPOSITION AND PROPERTIES OF A LITTLE-ORIENTED PYROLYTIC CARBON. J. Rappeneau (CEN, Saclay, France), M. Bocquet, M. Yvars, C. David, and A. Auriol. 44p. (CONF-73-9) (In French)

From 6th Biennial Conference on Carbon, Pittsburgh, June 1963.

Pyrolytic carbon obtained by thermal decomposition of acetylene, at partial pressures of 0.02 to 0.1 atm, on walls heated to between 1550 and 1650°C, is characterized by a low density (1.35) and a not very marked preferred orientation of the crystallites. The latter property is expressed by an absence of laminar structure in the deposit and by its good compatibility with an artificial graphite substrate. Following a description of the method of deposition and an outline of the structural properties, certain physical and chemical properties of the substance are also given. (auth)

34475 PRECISION MEASUREMENTS OF ELASTIC PROPERTIES OF GRAPHITE BY MEANS OF TRANSVERSE SONIC WAVES. R. Mendez-Penalosa and J. L. Otero (Junta de Energia Nuclear, Madrid). 24p. (CONF-73-10)

From 6th Biennial Conference on Carbon, Pittsburgh, June 1963.

A method is presented for determining the elastic modulus of graphite based on the measurement of the resonance frequency of transverse waves in cylindrical samples. Equations are given for computing Young's modulus using Goens' solution to Timoshenko's differential equation for transverse vibrations of bars with free ends. Samples of graphite with different ratios of radius of gyration to the length of the sample were examined in an effort to determine the optimum geometry for obtaining suitable excitation of the flexural waves. Values of Young's modulus for different types of graphite are given and the resonance

frequency of flexural wave versus density of graphite is presented as a function of the direction of extrusion axis. (auth)

Radiation Effects

Refer also to abstracts 34543, 34548, 34551, 34554, 34555, 34557, and 35191.

34476 (AERE-R-4322) EQUIPMENT FOR THE INVESTIGATION OF THE EMISSION OF FISSION PRODUCTS FROM IRRADIATED CERAMIC FUELS. D. Davies and G. Long (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). July 1963. 32p.

The equipment and experimental procedure used to investigate the emission at temperatures up to 2200°C of fission products from lightly irradiated samples of ceramic fuel materials are described. Important criteria in the design of the equipment and the methods of interpreting the data are discussed. (auth)

34477 (BNL-7156) DYNAMICS OF ATOMIC DISPLACEMENT PROCESSES. II. INFLUENCE OF CRYSTAL LATTICE ON CASCADES. Cavid Erginsoy (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract [AT(30-2)-Gen-16]. 24p.

Dynamic calculations carried out on the basis of a many-body lattice model of α-iron indicate that: 1) An actual cubic lattice (b.c.c. or f.c.c.) is highly anisotropic. The random model of radiation damage, which assumes that all directions are equivalent as far as displacement production is concerned, is inadequate in describing actual conditions. Cubic lattices show particular anisotropy when directions lying in the symmetry planes are compared with "interior" directions not lying in such planes. 2) Kinetic energy is not conserved in collisions between a pair of atoms in a crystal lattice since the range of the interatomic forces is not small compared with interatomic distances. A significant fraction of the total energy of a cascade resides as potential energy in lattice bonds. This fraction increases as the cascade proceeds. 3) As a rule, any displaced atom ends its actual history at a replacement collision. Many such replacements take place during a cascade. A sequence of replacements over several interatomic distances constitutes an important loss of energy which is not available to making displacements. Replacement collisions contribute to disordering the lattice but not to producing defects. The predominance of the replacements is due to directional correlations by the regular arrangements of atoms in the lattice as well as to the large region within which a Frenkel pair is unstable. 4) The number of defects made during cascades up to 1000 ev were calculated for a knock-on of given direction. More calculations are required with knock-ons of different directions in order to obtain $\bar{n}(E)$, the mean number of defects at energy E. The average energy consumed per defect appears to be of the order of 100 ev. 5) A displaced atom which involves a large sequence of replacements (i.e., a long effective history as compared to the actual history of each atom involved in the sequence) shows considerable loss of energy to nonproductive mechanisms. Thus the efficiency of a high-energy cascade in which an appreciable number of such sequences occurs is expected to be low compared to a low-energy cascade. The observed nonlinearity of $\bar{n}(E)$ vs E could be due to this mechanism. (auth)

34478 (CONF-39-60) RELEASE OF FISSION PRODUCTS BY THE IN-PILE BURNING OF IRRADIATED URANIUM CARBIDE–GRAPHITE FUEL. W. E. Browning, Jr., R. P. Shields, C. E. Miller, Jr., and B. F. Roberts (Oak Ridge National Lab., Tenn.). [nd]. Contract W-7405-eng-26. 13p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Three in-pile experiments were conducted to study the behavior of fission products when a fuel of pyrolytic carbon-coated uranium carbide particles in a graphite matrix is exposed to conditions simulating a reactor accident in which air passes over the hot fuel. The fuel was irradiated in a He stream in the Oak Ridge Research Reactor for 200 hr at 890°C and then exposed to air for 15 min at 890°C. Combustion commenced, the temperature went up to 1400°C, and ~50% of the fuel burned in the period of 15 min. The release of Sr, Zr, Ba, and Ce from the furnace was very low, but large fractions of I, Te, Cs, and Ru were released. (D.L.C.)

34479 (CONF-39-67) EFFECT OF SAMPLE SIZE ON RADIATION DAMAGE IN NEUTRON-IRRADIATED IRON. J. R. Beeler, Jr. (General Electric Co. Advanced Technology Services, Cincinnati). [1963]. Contract [AT(40-1)-2847]. 30p. (TM-63-6-4)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Machine calculations were made on the initial damage state produced in finite, neutron-irradiated iron specimens. A Monte Carlo calculation was used to compute the number of primary knock-on atoms (PKA) produced per incident neutron and their energy spectrum. Anisotropic neutron scattering in the center of mass system, as a function of neutron energy, was described by using experimental angular distribution data for the particular nuclear species concerned. A deterministic dynamical calculation, in which the bcc iron crystal structure was exactly represented, was used to estimate the size distribution of vacancy and interstitial clusters produced by PKA of a given energy. The density of clusters believed to be sufficiently large to increase the yield strength at elevated temperatures (~623°K) was found to vary with specimen size for a given neutron energy spectrum. The cluster density decreased with sample size for irradiation with isotropically incident neutrons but increased with sample size for irradiation with normal incident neutrons. When isotropic neutron scattering in the center of mass system was assumed, the cluster density was ~2.3 times that obtained for anisotropic neutron scattering. (auth)

34480 (CONF-63-4) PRIMARY KNOCK-ON SPECTRA AND POPULATIONS IN NEUTRON IRRADIATED BeO. J. R. Beeler, Jr. and J. W. Zwick (General Electric Co. Advanced Technology Services, Cincinnati). [nd]. Contract AT(11-1)-171. 13p.

From American Physical Society 1962 Summer Meeting in the West, Seattle, Aug. 1962.

The energy spectra and yields of primary knock-on atoms produced in BeO were calculated, assuming the atoms were produced by elastic neutron scattering. Neutron energy spectra from the ORR and ETR were used as well as monoenergetic neutrons with energies ranging from 0 to 1 Mev. Semi-infinite, slab, and column sample geometries were considered. (D.L.C.)

34481 (CONF-126-8) BEHAVIOR OF NOBLE GASES IN MOLTEN FLUORIDE REACTOR FUELS. S. S. Kirslis, F. F. Blankenship, and W. R. Grimes (Oak Ridge National Lab., Tenn.). [nd]. Contract [W-7405-eng-26]. 3p.

From Conference on Noble Gas Compounds, Argonne, Ill., Apr. 1963.

Results are reported briefly of experiments in which fluoride mixtures similar to the MSRE fuel ($BeF_2-LiF-UF_4-ZrF_4$) were irradiated with graphite specimens in sealed INOR-8 capsules at high temperatures. Postirradiation examination after several weeks of cooling at room temperature showed appreciable amounts of CF_4 in the cover gas of the capsule, complete recovery of the expected Kr but no Xe recovery, and serious radiolysis of the fluoride mixture. Other experiments indicate that F_2 is evolved and xenon fluorides are sorbed in the graphite only when the fluoride mixture is frozen; if the gas is sampled during irradiation at high temperatures, little CF_4 is found and both Kr and Xe are recovered. Radiolysis producing F_2 appears to be due to fission product decay. (D.L.C.)

34482 (CONF-166-9) THE EFFECT OF IONIZING RADIATION ON THE OPTICAL AND ELECTRICAL PROPERTIES OF THE ALKALI HALIDES. B. S. H. Royce (Princeton Univ., N. J.). [1962]. Contract AT(30-1)-937. 37p.

From American Society for Testing Materials 66th Annual Meeting, Atlantic City, June 1963.

Various mechanisms for the formation of point defects in ionic crystals are considered. Their probable importance as a function of the energy of the ionizing radiation and the temperature at which the irradiation takes place is discussed. Complex centers formed from aggregates of simple point defects are reviewed and their occurrence considered in terms of the expected spatial distribution of the point defects. The effect of high energy x rays and protons on the ionic conductivity is discussed in terms of a new interpretation of the conductivity curve as a function of temperature, and it is suggested that radiation-enhanced diffusion may be important in explaining the experimental data. (auth)

34483 (EUR-340.f) COMPORTEMENT SOUS IRRADIATION AUX NEUTRONS DE DIFFERENTES QUALITES INDUSTRIELLES DE SILICE VITREUSE. (Behavior Under Neutron Irradiation of Miscellaneous Industrial Qualities of Vitreous Silica). J. Elston and C. Gewiss (France. Commissariat a l'Energie Atomique, Paris). 1963. 49p.

The weak thermal conductivity of silica and its relatively low capture cross section enable it to be used as a structural material. Three industrial qualities of vitreous silica were studied: vitreous silica pressed under load in bricks, 100 × 100 × 50 mm; vitreous silica drawn in tubes, (ϕ 80 to 78 mm); and vitreous silica molded in tubes by centrifugal force, (ϕ 120 to 100 mm). Samples were taken of these three types of material to study the radiation effects on physical properties and mechanical characteristics of vitreous silica. For this purpose, samples were irradiated at a temperature neighboring 400°C in hollow fuel elements of the reactor EL-3. The integrated dose received was of the order of 2×10^{20} n_v/cm^2 (E > 1 Mev). The following main results were observed, in particular with the samples of pressed vitreous silica: average length decrease of 0.37%, density increase around 1.1%, and Young's modulus increase of 3 to 4%. The annealing at 600°C of irradiated samples for 50 hours resulted in a start of restoration of properties; for instance, at that stage, the Young's modulus had recovered about 18%. Thermal treatments lasting 75 hours at 1000°C stabilized vitreous silica. The sample density and Young's modulus were smaller than before irradiation. (auth)

34484 (EURAEC-656) FISSION GAS RELEASE FROM URANIUM DIOXIDE. Quarterly Progress Report No. 9, January–March 1963. (FIAT. Sezione Energia Nucleare, Turin). Work Performed under United States–Euratom Joint Research and Development Program. Contract 021-60-9 RDI. 12p. (FN-E-32)

The pellet experiments have confirmed the dependence of release rate parameter D′ values on burnup. As the exposure is increased, the apparent value of D′ decreases. The decrease of D′ with increasing exposures appears to be larger in CEA specimens than in the others. In fact, in CNEN and Mallinckrodt pellets this decrease was of approximately 3 to 20 times whereas for CEA specimens the apparent diffusion rates decrease was within a factor of 2 to 3 orders of magnitude for an average exposure increase from 3.5×10^{17} to 1.5×10^{18} fissions/cm^3. Activation energy for diffusion of xenon in uranium dioxide was calculated by plotting 1/T versus the log D′ values of couples of similar pellets annealed at different temperatures and subjected to similar irradiation exposures for taking into account the variation of the apparent diffusion coefficient above mentioned. Activation energy values resulted at 70–80 Kcal/mole. Additional evidence of fission gas bursts released from UO_2 pellets on cooling down from 1565°C was furnished. (auth)

34485 (HW-SA-2924) HIGH TEMPERATURE RADIATION EFFECTS IN LAMPBLACK-BASED GRAPHITES. H. H. Yoshikawa (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 3, 1963. Contract AT(45-1)-1350. 19p. (CONF-73-11).

From 6th Biennial Conference on Carbon, Pittsburgh, June 1963.

High-temperature radiation damage in lampblack-based graphites heat treated to 3000°C was studied in an effort to understand the mechanism of high temperature, radiation-induced contraction in graphites. Properties measured include length change, sonic modulus, thermal conductivity, coefficient of thermal expansion, electrical resistivity, and crystallite parameters. Annealing studies at 3000°C after irradiation at 650°C demonstrated the presence of a small annealable component of radiation-induced contraction in this material. Subsequent irradiation to a maximum neutron exposure of 2600 Mwd/at. followed by annealing showed that the annealed samples display significantly higher contraction than unannealed samples. These results are consistent with suggestions that high-temperature, radiation-induced contraction in graphite is associated with stresses generated during cooling from graphitization temperatures. (auth)

34486 (NMI-7009) A METALLOGRAPHIC STUDY OF GAS BEHAVIOR IN URANIUM IRRADIATED WITH ALPHA PARTICLES. Report to Savannah River Operations Office, United States Atomic Energy Commission. H. M. Green (Nuclear Metals, Inc., Concord, Mass.). Sept. 28, 1962. Contract AT(50-1)-1565. 57p.

The behavior of helium in uranium and in several uranium alloys was studied metallographically after room temperature irradiation with alpha particles in a cyclotron, followed by various heat treatments. The observed gas bubbles were classified in two classes, differing in size, concentration, and mechanism of formation. These bubbles appear to resemble those resulting from fission product gases in neutron-irradiated uranium; the findings of this study seem to be applicable to the understanding of the factors affecting bubble formation and thus to the suppression of swelling in neutron-irradiated materials. (auth)

34487 (NP-13011) MAGNETIC STUDIES OF IRRADIATED HEMATITE CRYSTALS. Annual Technical Report. Robert E. Ogilvie (Massachusetts Inst. of Tech., Cambridge). July 22, 1963. Contract Nonr 1841(84). 14p.

A natural crystal of hematite was ground into the form of a sphere about 0.16-in. in diameter. Magnetic measurements by the Curie method were made before and after neutron irradiation. Only small changes in the magnetic prop-

erties occurred after a fast flux of 6×10^{16} nvt. Following a second irradiation of 5×10^{17} nvt, several pronounced differences were observed in the magnetic behavior. Results indicated that lattice defects are a possible source of ferromagnetism in hematite. Possibly neutron irradiation produced a source of magnetism different from those existing previously. (M.C.G.)

34488 (NP-13014) CHARGED PARTICLE RADIATION DAMAGE IN SEMI-CONDUCTORS. V. EFFECT OF 1-Mev ELECTRON BOMBARDMENT ON SOLAR CELLS. J. M. Denney, R. G. Downing, W. I. Hoffnung, and W. K. Van Atta (Space Technology Labs., Inc., Redondo Beach, Calif.). Feb. 11, 1963. Contract NAS5-1851. 82p.

Solar cell devices including both contemporary and experimental cells were irradiated with 1-Mev electrons. Measurements of I-V characteristics, short circuit current densities, spectral response characteristics, and minority carrier diffusion lengths were obtained as a function of integrated electron flux. The results indicate that the critical fluxes required to produce 25 per cent damage in short circuit current range from 1×10^{13} e/cm^2 for the most sensitive 1 ohm-cm p on n Si solar cells to about 1×10^{15} for the most radiation resistant contemporary 10 ohm-cm n on p Si solar cells. Experimental Si solar cells were observed to exhibit critical fluxes as high as 4×10^{15} e/cm^2. In addition, gallium arsenide solar cells and cadmium sulphide solar cells were tested. The gallium arsenide solar cells exhibited critical fluxes approximately equal to that of the contemporary high resistivity n on p cells although the observed degradation rate was almost twice that of the silicon solar cells. The cadmium sulphide cells indicated negligible damage at integrated fluxes of 5×10^{16} e/cm^2. (auth)

34489 (NP-13031) CHARGED PARTICLE RADIATION DAMAGE IN SEMI-CONDUCTORS. IV. HIGH ENERGY PROTON RADIATION DAMAGE IN SOLAR CELLS. J. M. Denney, R. G. Downing, M. E. Kirkpatrick, G. W. Simon, and W. K. Van Atta (Space Technology Labs., Inc., Redondo Beach, Calif.). Jan. 20, 1963. Contract NAS5-1851. 73p.

Radiation damage produced in silicon by 95.5 Mev protons is experimentally described by measurements of short circuit current deterioration, changes in voltage-current characteristics, changes of minority carrier diffusion length, and comparative analyses of the photovoltaic and proton-voltaic effects. Most of the experimental specimens were silicon solar cells; 15 distinguishable groups of cells were studied and comprised n on p and p on n construction. In addition, a small number of gallium arsenide and graded base silicon solar cells were irradiated. The experimental results of the silicon cells were compared with the theoretical energy dependence of proton damage in silicon. The results indicate approximate agreement with theory. The experimental results of comparative studies of photovoltaic and proton-voltaic effects are analyzed critically using the results of supporting experimental measurements of the dependence of minority carrier lifetime on minority carrier density. It is shown that because of the dependence of minority carrier diffusion length on minority carrier density, the damage coefficient, K_p, obtained in silicon can vary by a factor of about two in p-type silicon and a factor of about 3.5 in n-type silicon exposed to 95 Mev protons. It is concluded that the damage coefficient obtained by the proton-voltaic effect at this energy is too large by these ratios for the description of solar cell deterioration under sunlight. (auth)

34490 (NP-13032) REVISION OF CHARGED PARTICLE RADIATION DAMAGE IN SEMICONDUCTORS. III. THE ENERGY DEPENDENCE OF PROTON DAMAGE IN SILICON. G. W. Simon, J. M. Denney, and R. G. Downing. (Space Technology Labs., Redondo Beach, Calif.). Feb. 15, 1963. Contract NAS5-1851. 11p.

As previously described, the spallation mechanism between an incident proton and a silicon target nucleus is a two-stage phenomenon, first involving a cascade interaction, followed by an evaporation stage. Previously, it was assumed that the target nucleus, after recoiling from the cascade interaction with an energy E_{RN}, emitted isotropically a number of nucleons in the evaporation stage, before slowing to rest by collisions with atoms in the silicon lattice. In calculating the defect density due to this recoiling nucleus, account was taken of both the fast nucleons M_{FP} and M_{FN} lost in the cascade, and the slow nucleons M_{SP} and M_{SN} emitted in the evaporation. However, it was assumed that the energy of the recoil nucleus, E_{RN}, was not changed during the evaporation process. Here, the changes in the defect density due to the following two modifications are described: a more detailed and accurate calculation, using the theory of LeCouteur, of the number of slow nucleons emitted; and a calculation of the change in E_{RN} during the evaporation, a phenomenon previously neglected. (N.W.R.)

34491 (REIC-27) THE EFFECT OF NUCLEAR RADIATION ON CERAMIC REACTOR-FUEL MATERIALS. James B. Melehan, Victor W. Storhok, Richard J. Burian, Mihkel Kangilaski, and Richard A. Wullaert (Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio). June 30, 1963. Contract AF33(657)-10085. 80p.

State-of-the art information on the effects of nuclear radiation on ceramic reactor fuel materials that are being used or being considered for use in various types of reactors is given. The materials discussed include uranium oxides, uranium carbides, uranium mononitride, uranium silicides, plutonium oxide, and plutonium carbide. Data are presented in the form of tables and curves for physical damage incurred by the fuel materials as a result of their exposure to nuclear radiation. (auth)

34492 (REIC-28) RADIATION-EFFECTS STATE OF THE ART, 1962–1963. (Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio). June 30, 1963. Contract AF33(657)-10085. 132p.

A review is presented of the progress and problem areas in radiation-effects activities. The current state of the art, recent results of radiation-effects studies, programs in progress, and Battelle's conclusions and recommendations are summarized for the following areas: electronic components and equipment; semiconductor devices and materials; polymeric materials; fuels, lubricants, and hydraulic fluids; structural metals and alloys; ceramics; space environment; and dosimetry. Steady-state radiation effects are emphasized, although pulse radiation is considered. (D.L.C.)

34493 LUMINESCENCE OF NEUTRON IRRADIATED ZnS PHOSPHORS. Toshio Yoshida and Shigeharu Koshino. Ann. Rept. Radiation Center Osaka Prefect., 3: 68-71(1962). (In English)

The results of experiments on the intensity and spectrum of luminescent emission for ZnS phosphors irradiated with neutrons are reported. It was found that a cubic ZnS crystal is more stable and more closely packed that a hexagonal one. Fractional luminescence intensity after irradiation was dependent on the amount of Cu activator. Neutron irradiation increased the relative intensity of the blue emission band compared to that of the green band for the samples activated with Cu of 0.001 or 0.01 wt %. The change was also observed at room temperature. No change in the spectrum was observed for samples activated with Cu of 0.5 wt % and

for samples activated with Ag at either temperature. (P.C.H.)

34494 THERMOLUMINESCENCE OF NEUTRON IRRADIATED ZnS PHOSPHORS. Toshio Yoshida, Hitoshi Nishimura, and Takeyoshi Seiyama. Ann. Rept. Radiation Center Osaka Prefect., 3: 72-4(1962). (In English)

The effects of neutron radiation on the thermoluminescence of cubic ZnS phosphors were investigated. The thermoluminescence intensity was decreased very little in the case of 1.5×10^{16} nvt irradiation. It was concluded that no new kind of trap was produced by neutron irradiation as far as shallow traps were concerned. The glow intensity was decreased as a whole to a value of the order 10^{-3} to 10^{-4} by neutron irradiation of 6.7×10^{16} nvt. Besides the decrease as a whole, the shape of the curve was changed remarkably. (P.C.H.)

34495 ELECTRON SPIN RESONANCE IN NEUTRON IRRADIATED ZnS PHOSPHORS. Yoshihiko Shono, Shigeharu Koshino, and Toshio Yoshida. Ann. Rept. Radiation Center Osaka Prefect., 3: 75-7(1962). (In English)

The effects of neutron irradiation on the electron spin resonance of cubic ZnS phosphors activated by Cu or Ag were investigated. No resonance signals were detected in any of the samples before neutron irradiation. All signals except for three that were characterized by g-values of 2.05, 1.88, and 2.01, respectively, were detected for every sample under appropriate conditions. The signals characterized by g = 2.05 and 1.88 were detected only at liquid nitrogen temperature and only when excited by ultraviolet radiation near 3600 Å. The decay of the signals is also discussed. (P.C.H.)

34496 DISCHARGE FIGURES IN DIELECTRICS BY ELECTRON IRRADIATION. Junichiro Furuta and Shinichi Okamoto. Ann. Rept. Radiation Center Osaka Prefect., 3: 82-5(1962). (In English)

A method for the breakdown of dielectrics under electron beam irradiation and subsequent formation of tree-like discharge figures, called Lichtenberg Figures, is given. A dielectric sample is pricked on the surface with a needle and then irradiated until the first discharge occurs. The stem of the pattern starts from the prick. The size and figure of the discharge pattern depend on the integrated dose to the first discharge. The formation characteristics of the discharge pattern of methyl methacrylate polymer were studied. It was concluded that the magnitude and figure of Lichtenberg patterns in a dielectric can be controlled by the depth of prick on it. (P.C.H.)

34497 ELECTRONIC CONDUCTION AND BREAKDOWN IN γ-RAY IRRADIATED KCl SINGLE CRYSTALS. Yoshio Inuishi and Yung-Kwon Sung. Denki Gakkai Zasshi, 82: 1909-18(Dec. 1962). (In Japanese)

In order to clarify the nature of the effects due to crystal imperfections on the pulse photoconduction in the pre-breakdown range and at dielectric breakdown, the KCl crystal samples (0.3 mm thick, and grown by the Kyropoulus method) were irradiated from a Co^{60} source at a dosage rate of 3×10^5 r/hr in room temperature. It was found that the product of the electron mobility times the lifetime in γ ray induced colored KCl decreases with increasing temperature in the order of 10^{-7} cm^2/sec. The quantum yield for conduction production from F center decreases remarkedly at low temperatures, especially at −60°C. The d-c breakdown strength increases remarkably at room temperature. The temperature dependence of breakdown strength coincides well with the theoretical tendency that takes the intersection of polar optical mode as the predominant factor. (OID)

34498 THE EFFECTS OF γ-RAY IRRADIATION ON ELECTRIC PROPERTIES OF POLYSTYRENE. Tatto Nakai and Takeshi Sakakibara. Denki Gakkai Zasshi, 82: 1919-27 (Dec. 1962). (In Japanese)

The Co^{60} γ-ray-induced effects on the polystyrene membrane, a principal component of a capacitor, as well as the polystyrene capacitor were studied. Radiation effects on the electric properties of the capacitor and the membrane were not necessarily the same. In the former, increase in irradiation dosage caused an increase in volume and decrease of the insulation resistance and insulation breakdown. In the latter, however, there were little changes observed in dielectric property, volume, or resistance. As to its insulation breakdown, it varies depending on the irradiation conditions. The difference is accredited to the heat treatment while manufacturing the capacitor, and to the small change in the electrode contact because of the mechanical property changes of the irradiated components. The breakdown properties are compared when irradiated in air and in vacuo. In air, the polystyrene main chain is broken at about 10^8 r to form carbonyl radicals; hence its average mol wt is lowered, and it becomes harder and more brittle as the kinetic elasticity increases. Yellow coloring also occurs under intense radiation. In vacuo, however, the average mol wt is increased, and its gelation occurs at about 10^7 r with no change in its elasticity. (OID)

34499 EFFECT OF TEMPERATURE AND NEUTRON IRRADIATION ON YIELD AND WORK HARDENING IN IRON. I. L. Mogford and D. Hull. J. Iron Steel Inst. (London), 201: 55-60(Jan. 1963). (AERE-R-4009)

The neutron irradiation of cold swaged and annealed pure Fe wires at 60 to 100°C, and tensile testing at 293 to 78°K to determine the effect of temperature and irradiation on the lower stress and the work hardening rate is reported. A comparison was made between the decrease in work hardening rate with increasing strain and the decrease produced by irradiation. (Rev. Metal Lit., 20: No. 6, June 1963)

34500 ELECTRIC CONDUCTION OF IRRADIATED POLYETHYLENE. Masayuki Ieda, Masamitsu Kosaki, and Ukichi Shinohara (Nagoya Univ., Japan). J. Phys. Soc. Japan, 18: 1103-4(July 1963).

Three kinds of polyethylene, differing in density and having a different amount of crystalline region, were irradiated with 2-Mev electrons in air to doses of 3, 15, and 45 Mrad. Measurements of the volume resistivity vs temperature characteristics were performed eight months after irradiation. Although the resistivity has a linear relation to temperature below a certain temperature as in usual polymers, a rapid increase in resistivity appears within a narrow temperature region at about 10°C above this temperature. The resistivity increase is very large and the value reached is ~10-10^2 times the value just before the increase. After passing through this region the resistivity decreases with temperature again. This phenomenon is not observed in unirradiated specimens. Irradiated specimens annealed once never show this thermal hysteresis again. It is suggested that charge carriers created by irradiation are captured by trapping centers in the crystalline region, but not in the amorphous region, and their thermal release contributes to the electric conduction. (C.E.S.)

34501 ON THE RESISTANCE OF PLASTICS TO RADIATION. I. SUSTAINED IRRADIATION TESTS ON PLASTIC PIPES. H. Wilski, E. Gaube, and S. Roesinger (Farbwerken Hoechst AG, Frankfurt am Main). Kerntechnik, 5: 281-5(July 1963). (In German)

Sustained irradiation tests on pipes made from dense

polyethylene, polypropylene, and polyvinylchloride (suspension- and emulsion PVC) in all cases resulted in considerable damage to the pipes, even when using relatively small irradiation doses of 1–5 Mrad. The maximum permissible irradiation doses for pressure pipes were estimated; the difference in their behavior on prolonged and short irradiation times is explained. Pipes of dense polyethylene that were subjected to less radiation have proved themselves in practical use. (auth)

34502 THERMAL RESISTIVITY OF IRRADIATED GRAPHITE. R. L. Woolley (Central Electricity Generating Board, Berkeley, Gloucestershire, Eng.). Nature, 199: 684-5(Aug. 17, 1963).

It is shown that the explanation for the extra phonon scattering arising from the irradiation in thermal resistivity measurements on irradiated polycrystalline graphite is not entirely satisfactory. An alternative approach is suggested in which the grain boundary is regarded as a sink for interstitial clusters. A theoretical expression is derived for the thermal resistivity that represents the previous experimental results fairly well. (C.E.S.)

34503 AVAILABILITY OF GAMMA FACILITIES. Nucleonics, 21: No. 8, 126-7(Aug. 1963).

Information on the costs, features, availability, and requirements of available U. S. and Canadian gamma-irradiation facilities is presented. (D.C.W.)

34504 THE STRAIN RATE DEPENDENCE OF THE FLOW STRESS IN NEUTRON IRRADIATED COPPER SINGLE CRYSTALS. T. J. Koppenaal (Argonne National Lab., Ill.). Phil. Mag. (8), 8: 1313-20(Aug. 1963).

The influence of neutron irradiation, from dose levels of 1.0×10^{15} to 0.97×10^{19} nvt, on the strain rate dependence of the flow stress in copper single crystals has been investigated at 77 and 300°K. An analysis of this dependence shows that the activation energy for dislocations cutting obstacles introduced by the irradiation decreases with decreasing testing temperature and increasing neutron dose. Thus, a unique activation energy cannot be assigned to the process. This result is explained on the basis of variations in both the size and the density of the obstacles. (auth)

34505 A TRANSIENT IRRADIATION CREEP IN NON-FISSILE METALS. R. V. Hesketh (Berkeley Nuclear Labs., Berkeley, Glos., Eng.). Phil. Mag. (8), 8: 1321-33 (Aug. 1963).

Relaxation strains between 2×10^{-5} and 10^{-4} have been observed in iron, high carbon steel, stainless steel, and zirconium, after fast neutron doses between 2×10^{19} and 3×10^{20} cm^{-2}, at stresses between 1 and 3 kg mm^{-2}, and at temperatures about one-fifth of the melting temperature. In iron, the relaxation appears complete at a neutron dose of 2×10^{19} cm^{-2}, and its lack of temperature dependence indicates that it is not an acceleration of thermal creep. In the steels, correlation with other results shows that the relaxation is proportional to stress. Vacancies and interstitials created by irradiation give rise to a chemical stress on dislocations. Dislocation climb under this stress, the external stress, and the line tension of the dislocations gives a final creep strain which is independent of temperature and proportional to stress. For the stresses used, a final strain of 5×10^{-5} is predicted in a material containing a random array of dislocations. The order of magnitude of the calculated initial strain rate is also correct. (auth)

34506 FISSION FRAGMENT DAMAGE TO CRYSTAL LATTICES: HEAT-SENSITIVE CRYSTALS. L. T. Chadderton and H. M. Montagu-Pollock (Univ. of Cambridge, Eng.). Proc. Roy. Soc. (London), Ser. A, 274: 239-52 (July 23, 1963).

Uranium fission fragment damage in thermally unstable crystals is considered. Thin single crystals of silver cyanamide, the thiocyanates of silver and mercury, the picrates of ammonium, potassium, and thallium, ammonium iodate, and ammonium borofluoride were irradiated and directly examined by transmission electron microscopy. A considerable variation was found in the type and amount of damage. According to the irradiated material, each fragment produces a track of up to 140Å in width, which can represent either missing material or an alteration to the crystal structure, and can be either continuous or discontinuous. With some materials the damage does not take the form of a visible track. The observed amount of damage is found to be consistent with that calculated on the basis of a model of damage by heat alone, involving either decomposition or evaporation. An important parameter is the radius of the cylindrical volume within which the energy lost by the fission fragment appears as heat. This radius is determined primarily by the range of the electrons that are released by the passage of the fragment and transfer its energy to the crystal lattice. It is likely that only in an intrinsic semiconductor is the range of these electrons low enough for the production of visible tracks in single crystals. The possibility of further damage or explosion, subsequent to irradiation, is briefly considered. (auth)

34507 FORMATION ENERGY OF VACANCIES IN GRAPHITE CRYSTALS. C. A. Coulson (Oxford Univ.), M. A. Herraez, Matilde Leal, E. Santos, and S. Senent. Proc. Roy. Soc. (London), Ser. A, 274: 461-79(Aug. 13, 1963).

A theoretical discussion is given of some of the energy factors associated with single vacancies in an otherwise perfect graphite lattice, caused by neutron bombardment. First, the loss of π-electron energy is shown to be $2.76 \pm 0.05\beta$ where β is the molecular-orbital resonance integral for a carbon-carbon bond. Secondly, a careful account is provided of the symmetries of the various electronic states that are possible if it is supposed that the three electrons of the atoms adjacent to the vacancy are allowed to interact and form a pseudo-molecule. The energies of these states are calculated, taking account of configuration interaction. It is shown that the lowest state for a neutral vacancy would be a doubly-degenerate state of symmetry $^2E'$. This would lead to a Jahn–Teller equilibrium deformation. Such deformation would not be expected to be large, or to modify the numerical results to any great extent. Finally, the earlier numerical values are combined with the experimental heat of atomization of graphite, and lead to a value for the heat of formation of a vacancy equal to about 10.7 ev. This differs considerably from the observed value, which is of the order of 3.4 ev. It is concluded that the model of a vacancy used may possibly not be correct, and an alternative suggestion is put forward. 40 references. (auth)

34508 THE FABRICATION, PROPERTIES, AND IRRADIATION STABILITY OF DISPERSION-TYPE FUELS. D. T. Livey (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Brit. Ceram. Soc., 62: 197-220(Mar. 1963).

A dispersion-type fuel is defined and the advantages that might be gained by the use of such fuels are outlined. Two types of fuel are considered: oxide based and carbide based. The carbide fuel is illustrated by the carbon-coated carbide fuel particle and the fabrication of such particles is breifly described. The oxide fuel is illustrated by the systems $BeO-UO_2$, $Al_2O_3-UO_2$, and $MgO-UO_2$, and the fabrication of such fuels is considered. The properties

of the dispersed systems are considered in terms of the known properties of the various materials and the problems that exist with regard to phase stability, relative thermal expansion, thermal conductivity, and permeability are outlined. The dimensional stability of dispersed fuels under irradiation is considered and available information on the problem is presented. (auth)

34509 IRRADIATION STABILITY OF DISPERSION FUELS. J. D. B. Lambert (Atomic Energy Research Establishment, Harwell, Berks. Eng.). Trans. Brit. Ceram. Soc., 62: 247-55(Mar. 1963).

An 18.7 wt % UO_2–Fe dispersion was examined in detail both as irradiated to 10–14% burnup of uranium atoms and after post-irradiation heat treatment to 1200°C. The formation of fission-gas bubbles in the UO_2 particles and the precipitation of gas bubbles in the iron matrix were investigated and the importance of the precipitation in determining volume stability of the cerment at high temperature is stressed. (auth)

34510 EFFECTS OF IRRADIATION ON THE ELECTRICAL RESISTIVITY OF CAST URANIUM CARBIDE. B. G. Childs and A. Ogilvie (United Kingdom Atomic Energy Authority, Thurso, Caithness, Scotland). Trans. Brit. Ceram. Soc., 62: 289-97(Mar. 1963).

The electric resistivity at 20°C of cast uranium monocarbide was measured as a function of neutron exposure over the range $0-10^{19}$ n/cm^2. The specimens, which were of natural isotopic content, were irradiated at temperatures estimated to be less than 80°C. The resistivity increased with exposure in an inverse exponential fashion, increases of up to 150% of the original values being observed for previously annealed specimens containing precipitated UC_2. Pure specimens, that were free from UC_2, and also UC_2-containing specimens that had been contaminated by tungsten during melting, increased rather less in resistivity—typically by 114% after 10^{19} n/cm^2. On the subsequent annealing of the specimens in a series of increasing-temperature steps, between 50 and 70% of the fractional resistivity increment was removed over the interval 100 to 400°C. No effect of exposure on the annealing behavior was detected. (auth)

34511 RADIATION-DAMAGE STABILITY OF POLYVINYLCHLORIDE PLASTICS OF INSULATION AND JACKET PRESCRIPTIONS. V. M. Anikeenko, K. M. Kevroleva, P. M. Kossenikh, and V. Sotnikov. Vestnik Elektroprom., No. 6, 16-20(1962).

Six insulation type and two jacket type plastics were irradiated with doses from 0 to 220×10^6 rad. The results of the measurements of the electrical and mechanical properties of irradiated samples showed that a substantial decrease of tensile strength and of the respective elongation of the plastic starts at 5×10^6 rad. The biggest change of σ_r occurs in the region from $(5 + 50) \times 10^6$ rad. At a dose of 150×10^6 the tensile strength of a plastic containing 40% of plasticizer, decreased by 20% of its initial value; whereas that containing 60% of plastificator by 60% of the initial tensile strength. Irradiation caused chemical changes of the structure and therefore the resistivity decreased at 150×10^6 rad to 3–37% of the initial one. At a total dose of 10^6 rad the temperature-frequency change of the tg δ was about a 200% increase. The frost-resistance of the polyvinylchloride plastic decreases starting from the dose of 15×10^6 rad. The decomposition temperature starts decreasing from 5 to 15×10^6 rad. Structure changes appeared at 150×10^6 rad. The best results were found with materials containing tricresyl phosphate as plasticizer. No improvement of physico-chemical characteristics of polyvinylchloride plastics under irradiation up to 150×10^6 rad was observed. The x-ray structure analysis data showed more regularity of the structure of the polymer's chains. (OTS)

34512 RADIATION DAMAGE IN SOLIDS. Vol. III. Part of the Proceedings of the Symposium on Radiation Damage in Solids and Reactor Materials Held at Venice, May 7-11, 1962. (International Atomic Energy Agency, Vienna). Proceedings Series. June 1963. 195p. STI/PUB/56(Vol.III). $4.00; Sch 84; 24s.stg; NF 16; DM 14 (IAEA).

Fifteen articles are included; separate abstracts were prepared for 6. The remaining 9 previously abstracted in NSA include information on radiation effects on semiconductors and ionic crystals. A separate author index is appended. (P.C.H.)

34513 EFFECTS OF RADIATIONS ON SEMICONDUCTORS. REVIEW OF GENERAL EFFECTS. P. Baruch (Ecole Normale Supérieure, Paris). p.3-13 of "Radiation Damage in Solids. Vol. III." Vienna, International Atomic Energy Agency, 1963. (In French)

A review is presented on the effects of radiation on semiconductors. Problems in the study of radiation effects on semiconductors and the structure and nature of defects produced in silicon and germanium, which are typical semiconductors, are discussed. (P.C.H.)

34514 ACCELERATED DIFFUSION IN SILICON. P. Baruch and J.-C. Pfister (École Normale Supérieure, Paris). p.43-8 of "Radiation Damage in Solids. Vol. III." Vienna, International Atomic Energy Agency, 1963. (In French)

Information was obtained on the mechanism of annihilation of defects in silicon for temperatures between 800 and 1200°C. An attenuation length of 1 to 3 μm, which is related to the diffusion length of the defects, was measured. The values were found to depend on the density of the dislocations. (P.C.H.)

34515 THERMAL ANNEALING OF CHEMICAL RADIATION DAMAGE IN IONIC CRYSTALS FOLLOWING (n,γ) AND ISOMERIC-TRANSITION ACTIVATION. G. B. Schmidt, K. Heine, and W. Herr (Université de Cologne and Max-Planck Institut fur Chemie, Mainz). p.93-102 of "Radiation Damage in Solids. Vol. III." Vienna, International Atomic Energy Agency, 1963. (In English)

Investigations were made in some detail by conventional chemical precipitation and paper electrophoresis, on the reactions of recoil defects in crystalline hexahalogen and pentamminebromo complexes of the platinum elements. In solid-state physics, several models were developed to explain the annealing of lattice vacancies and interstitials. But the simplifying models do not sufficiently describe the annealing of recoil fragments in ionic crystals. For instance, in $Na_2IrCl_6 \cdot 6H_2O$ several different recoil fragments were observed whose individual annealing behavior indicates a superposition of physical and chemical processes. The results show that chemical aspects are also important to explain radiation damage in ionic crystals. (P.C.H.)

34516 EFFICIENCY OF THE VARLEY MECHANISM FOR VACANCY PRODUCTION IN ALKALI HALIDES. G. Chiarotti and G. F. Nardelli (Università, Pavia, Italy). p.135-46 of "Radiation Damage in Solids. Vol. III." Vienna, International Atomic Energy Agency, 1963. (In English)

The efficiency for the ejection of an ionized halogen from a regular lattice position into an interstitial position was investigated in the two cases of double ionization in inner

and outer shells. The various contributions to the potential energy (Madelung, repulsive, and polarization energies) were evaluated for a number of points in the (111) direction with the aid of an electronic computer. The polarization energy was estimated to zero-order approximation, and the repulsive interaction was limited to the first neighbors. Inspection of the potential energy curves showed that, in the case of a halogen doubly ionized into inner shells, the ejection is highly improbable. On the other hand, the ejection mechanism might be operative when the halogen is doubly ionized into its outer shell, provided that the time for the delocalization of the two holes is larger than 3×10^{-15}s. (auth)

34517 EFFECTS OF RADIATION ON THE MECHANICAL PROPERTIES OF IONIC CRYSTALS. E. Andronikashvili, N. Politov, L. Vorozheikina, and M. Getiya. p.147-62 of "Radiation Damage in Solids. Vol. III." Vienna, International Atomic Energy Agency, 1963. (In Russian)

Using solid alkali-halide crystals as models, the structural changes occurring under hard radiation and neutron irradiation were investigated and the intrinsic relations between structure and such fundamental mechanical properties as resistance to plastic deformation and destruction were elucidated. With KCl crystals, it was found that the two properties change differently in relation to the increase in the integral dose of neutron irradiation received. While resistance to deformation, after an initial increase, will lead to saturation, resistance to destruction is at first reduced and then begins to be restored. In the same dose range, the resistance of LiF crystals to deformation and their resistance to destruction changes uniformly, increasing as the dose increases and exhibiting two stages: rapid initial growth, followed by a much slower linear growth. Peculiarities in the behavior of LiF are possibly explained by the fact that, in these crystals, the determining factor is the break-up of the lithium nuclei following slow-neutron capture into helium and tritium nuclei. Other experiments have shown that, under neutron irradiation, bubbles of the gases are formed in LiF crystals. The nature of the change in the fundamental mechanical properties of the KCl crystals taken in conjunction with the data obtained on the change in density of structural defects indicates that the above peculiarities are connected with the generation of dislocations by radiation, an effect that was detected. In the dose range in which the appearance of new dislocations was observed under neutron irradiation (nvt thermal = $5 \times 10^{15} - 10^{16}$ neutrons/cm^2), the onset of saturation in the curve for the dependence of resistance to deformation on integral flux also occurs. It must be assumed that, starting with these doses, the radiation point defects generated are condensed in the dislocation. This process is also the determining factor in the saturation effect since the point defects that cease to come into play are the very ones that are capable of causing an increase in tension, necessary for displacing the dislocation. It is shown that a simple comparison of the nature of the change in mechanical properties and the change in the density of the electron local centers (F-centers) is inadmissible (although often made), since the effect of the centers is suppressed by the much stronger influence of other radiation defects occurring during neutron irradiation. In experiments involving the use of pure, hard radiation the true mechanical effect of the F-centers was established, and it is shown that an increase in their density leads to a decrease in resistance both to deformation and to destruction. (P.C.H.)

34518 MEASUREMENT OF THE COMBINED EFFECTS OF NUCLEAR RADIATION AND CRYOTEMPERATURES ON NON-METALLIC SPACECRAFT MATERIALS. E. T. Smith (General Dynamics Corp., Fort Worth, Tex.). New York, Atomic Industry of Electronic Engineers, 1963, Preprint CP 63-1175, 35p, $1.00. (CONF-1-20; FZM-2937)

From Summer General Meeting, Toronto, June 1963.

Tests were conducted to measure the combined effects of nuclear radiation and cryotemperatures on the tensile and compressive properties of non-metallic spacecraft materials. The Ground Test Reactor (GTR) at the Nuclear Aerospace Research Facility (NARF) at General Dynamics/Fort Worth was used as the radiation source. Special equipment to submerge test specimens in liquid nitrogen or liquid hydrogen during irradiation and subsequent testing was designed and built at NARF. Results of the tests were sufficient to demonstrate the effects of the combined environment and to make recommendations for use of the materials in nuclear-powered spacecraft. (auth)

34519 NOISE SIGNALS AND CARRIER MODULATION ARISING IN ELECTRICAL CABLES DURING NUCLEAR PULSE IRRADIATION. Eberhard Both, Horst P. Bruemmer, Charles P. Lascaro, Joseph Newberg, and William Schlosser (Army Electronics Research and Development Lab., Fort Monmouth, N. J.). 6p. (CONF-58-3)

From Inst. of Electrical and Electronics Engineers International Convention, New York, Mar. 1963.

Electrical noise signals generated in coaxial and other cables by pulsed nuclear radiation were measured as a function of applied voltage and exposure history. In consecutive exposures the signal magnitude and polarity was found to be strongly affected by training and memory effects. Unexpectedly large signals in the cable shield were identified as the cause for oscillatory signals in the center conductor and for the occurrence of parasitic leakage currents in nearby conductors. A r-f signal transmitted through RG62 A/U cable undergoes a temporary attenuation during the radiation pulse while it passes through RG59 B/U without measurable degradation. Definite rules are given for minimizing cable noise signals in nuclear pulse radiation measurements. (auth)

34520 SURFACE EFFECTS OF RADIATION ON TRANSISTORS. R. R. Blair (Bell Telephone Labs., Inc., Whippany, N. J.). 16p. (CONF-1-22)

From Institute of Electrical and Electronics Engineers Meeting, Toronto, June 1963.

Surface effects caused by ionizing radiation were found to result in serious parameter changes in certain transistors. These effects include large increases in leakage current, changes in gain, and increases in noise. Studies were made of the effects of dose, dose rate, bias, transistor environment, and surface protection, in addition to the phenomena of recovery and memory. The greatest changes occur when bias and radiation are applied simultaneously to a gas-encapsulated silicon transistor with unprotected surfaces. Most of these effects can be qualitatively explained through the use of a simple model of the process. Radiation ionizes the encapsulating gas, and the resulting ions and electrons are directed to transistor surfaces by electric fields at the junction surfaces and between the transistor and its can. Inversion layers are produced at the surface that grossly change certain transistor parameters. The great variability among devices of the same type suggests that the gas ions interact with the surface by imparting charge to surface contaminants. Detailed investigation of the influence of electric fields between a transistor structure and its can were carried out on special gas-encapsulated mesa and planar transistors that are electrically insulated from their cans. Results indicate

that inversion layers on both collector and base are affecting I_{CBO}, while, as would be expected, gain is altered principally by an inversion layer on the base. In the gas-encapsulated planar devices the effect of can bias on I_{CBO} is greatly reduced and its effect on gain is practically zero. (auth)

34521 BEHAVIOUR UNDER NEUTRON IRRADIATION OF MISCELLANEOUS INDUSTRIAL QUALITIES OF VITREOUS SILICA. J. Elston (Commissariat à l'Energie Atomique, Paris) and C. Gewiss. 49p. (CONF-120-28; EUR 340.f).

From IAEA Conference on the Technology of New Nuclear Materials, Prague, July 1963.

Three industrial qualities of vitreous silica were studied: vitreous silica pressed under load in bricks, 100 × 100 × 50 mm; vitreous silica drawn in tubes (80–78 mm diam); and vitreous silica molded in tubes by centrifugal force (120–100 mm diam). Samples were taken to study the irradiation influence over physical properties and mechanical characteristics of vitreous silica. Samples were irradiated at a temperature neighboring 400°C in hollow fuel elements of reactor EL-3. The integrated dose received is of the order of $2.10^{20} n_r \cdot cm^{-2}$ (E > 1 Mev). The main results observed, in particular with the samples of pressed vitreous silica, were: average length decrease 0.37%; density increase around 1.1%; and young's modulus increase 3 to 4%. The annealing at 600°C of irradiated samples during 50 hours resulted in a start of restoration of properties, for instance, at that stage, the young's modulus has recovered about 18%. Thermal treatments lasting 75 hours at 1000°C stabilized vitreous silica. It was also observed that the sample density and their young's modulus were smaller than before irradiation. (P.C.H.)

34522 TELEMETRY CIRCUITS IN A RADIATION ENVIRONMENT. H. L. Olesen (General Electric Co., Philadelphia). 16p. (CONF-163-1)

From 1963 National Telemetering Conference, Albuquerque, N. Mex., May 1963.

Radiation effects are a serious problem for designers of space vehicle electronic equipment. By simulating the environment and irradiating various components and circuits, more and more data become available for engineering application. However, it is not possible to simulate the pulsed radiation environment correctly, because it is not possible to obtain the high radiation intensities occurring in the actual environment. The following represents experimental data obtained at radiation intensities $>10^{12}$ rad/sec. This is an intensity 4 to 5 orders of magnitude greater than previous experimental data. (auth)

34523 TEMPERATURE-RADIATION EFFECTS ON MATERIALS IN SPACE; A REVIEW. J. F. Watson (General Atomic Div., General Dynamics Corp., San Diego, Calif.). 17p. (CONF-166-7; GA-4121)

From American Society for Testing Materials 66th Annual Meeting, Atlantic City, June 1963.

Although work is in progress on both simple alloys for fundamental information and complex high-strength alloys for engineering design data, far more work is required to allow these alloys to be used confidently under these extreme combined environments. At the high temperature end of the temperature scale, additional creep and stress rupture data are needed under dynamic conditions, which are the analog of the nuclear flight conditions, and the observed properties must be correlated with microstructural behavior. Likewise, at the low end of the temperature scale, understanding of radiation effects must be improved by means of tests performed under continuous cryogenic conditions. It is only with these data and a complete understanding of their significance that we can hope to design and build airborne structures of proven structural integrity to operate in the combined environments of temperature extremes and neutron fluxes. (auth)

34524 COMPUTER CODES FOR SPACE RADIATION EFFECTS. D. L. Dye (Boeing Co., Seattle). 14p. (CONF-166-5)

From American Society for Testing Materials 66th Annual Meeting, Atlantic City, June 1963.

A computer code is developed that calculates the defect density induced in a semiconductor device by space protons incident upon an external shield around the device. Results depend critically on low-energy spectral details of the incident protons. For several typical spectra, normalized to allow multiplication by a suitable flux value, defect densities in silicon as a function of shielding thickness are given. (auth)

34525 EFFECTS OF VACUUM AND NUCLEAR RADIATION ON ENGINEERING MATERIALS. W. R. Lucas (George C. Marshall Space Flight Center, Huntsville, Ala.). 30p. (CONF-166-6)

From American Society for Testing Materials 66th Annual Meeting, Atlantic City, June 1963.

The state of knowledge on the resistance of engineering materials to vacuum, radiation, and radiation plus vacuum is discussed, with emphasis on vehicle and reactor accessory hardware rather than on reactor materials. Selected data obtained from the investigation of the combined effects of reactor radiation and vacuum on organic engineering materials are discussed. The data include results of mechanical tests prior to and after irradiation. The test specimens are representative samples of thermal insulation, potting compounds, structural laminates, structural adhesives, thermal control coatings, dielectric materials, seals, and lubricants. (P.C.H.)

34526 THE EFFECTS OF GAMMA RADIATION ON GLASS COATED SILICON TRANSISTORS. M. M. Weiss and W. P. Knox. 21p. (CONF-1-23)

From Institute of Electrical and Electronics Engineers 1963 Summer Meeting, Toronto, June 1963.

Investigations were made on the effects of gamma radiation on the medium surrounding the junction and surface impurities of glass coated silicon transistors. The bare devices were dipped in a high purity low melting point glass consisting of 24% As, 67% S, and 9% I by weight. The results indicate that the glass coating process significantly decreased the magnitude of the increase of reverse collector-base current (I_{CBO}) of the devices so treated when placed in a gamma radiation environment. It was also shown that the glass coating process is substantially as effective in reducing the radiation as the planar device construction technique. When gamma radiation is applied while the bias is on, two effects appear. There is an initial instantaneous rise in I_{CBO} and then a continued increase of the current during further exposure. However, the glass coated devices showed a much smaller increase for varying exposures than the controls. (P.C.H.)

34527 POLYETHYLENE IRRADIATION PROCESS. Kenneth Stevens (to Distillers Co. Ltd.). U. S. Patent 3,099,611. July 30, 1963. Priority date Oct. 29, 1958, Great Britain.

A process for the production of material from linear polyethylene having improved stress cracking resistance is presented. The linear polyethylene is irradiated with any type of high-energy ionizing radiation to a dose of 10^6–10^7 rads while in contact with vinyl chloride. (C.E.S.)

PHYSICS

General and Miscellaneous

Refer also to abstracts 33441 and 34430.

34528 (AI-8672) CLAD CARBIDE NUCLEAR FUEL THERMIONIC POWER MODULES. Quarterly Report No. 1. C. K. Smith (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 1963. Contract AF33(657)-10876. 25p.

The general objective is to evaluate a clad carbide emitter, thermionic power module which simulates nuclear reactor installation, design, and performance. The module is an assembly of two series-connected converters with a single common cesium reservoir. The program goal is 500 hours cumulative operation at a power density of 7 watts/cm^2 and an efficiency of 12%. This report describes progress made during the first program quarter, including: (1) design finalization; (2) component and fueled emitter design and fabrication; (3) BeO–Cs compatibility; and (4) operation of a UC–Re planar electrode converter for the most successful high performance test ever achieved with a converter containing nuclear fuel, either in-pile or out-of-pile. (auth)

34529 (ANL-6676) TABULATIONS OF CALCULATED CRYSTALLOGRAPHIC DATA FOR ALPHA PLUTONIUM. Alan F. Berndt and Lowell T. Lloyd (Argonne National Lab., Ill.). June 1963. Contract W-31-109-eng-38. 93p.

Calculations were made of the powder pattern and of the angles between planes and directions for alpha plutonium in order to provide useful data for interpretation of x-ray patterns. The calculated powder patterns for Cu, Ni, Co, Fe, Cr, and Ti Kα radiations are tabulated. The angles between planes and the angles between directions are listed, and the standard projections are presented. (auth)

34530 (ASD-TDR-63-707) EXPLORATORY ENERGY CONVERSION STUDY OF PHOTON THERMIONICS. M. D. Gibbons (General Electric Co. Power Tube Dept., Schenectady, N. Y.). June 1963. Contract AF33(657)-9202. 40p.

This study was initiated to determine whether photon processes could increase thermionic converter performance. A converter designed specifically for program use was fabricated with a wire grid collector placed in grooves of a sapphire window and located opposite a planar emitter, then tested with five different radiation sources, each with a particular spectral characteristic. Only the 200 watt-sec xenon flash lamp produced an effect on converter operation. This lamp produced a 20% increase in short circuit current with the converter operating in the ion-rich region, and at least an order of magnitude change in short circuit current in the electron-rich region. In this latter region, the current was still somewhat space charge limited even with radiation. A third of the observed effect was due to 0.8 watt cm^{-2} of the first resonance radiation, while a fourth of the observed effect was due to one watt cm^{-2} of near ultraviolet. Photon-enhanced converters appear possible, but it must be demonstrated whether the increase in performance will be offset by the complexity of such a converter. (auth)

34531 (ASD-TDR-63-723) EXPLORATORY STATIC ENERGY CONVERSION-MULTILAYER THERMIONICS. Final Report. P. R. Emtage and W. J. van der Grinten (General Electric Co. Electronics Lab., Syracuse, N. Y.). Aug. 1963. Contract AF33(657)-9204. 101p.

A static heat-to-electricity conversion principle was studied and is described. The principle involves an attempt to duplicate the performance of a vacuum tube thermionic converter, in the solid state and at a lower temperature. The basic arrangement is a multiple thin film structure, consisting of alternate layers of semiconductors and metals, arranged perpendicular to the direction of heat flow. Transverse and longitudinal Seebeck voltage measurements were made on mono- and multilayers of germanium films. Depending on the electrode material used, transverse p-type Seebeck voltages as high as 30 μv across 4000 Å of sputtered germanium were observed, using a heat pulse type technique. Thermoelectric anisotropies are very pronounced. Temperature dependencies in the vicinity of room temperature were found to be relatively small. Theoretical considerations suggest that the basic mean free path limitations that apply to charge carriers in a given semiconductor or insulator control the conversion efficiency of solid state thermionics to the same extent as they do in conventional thermoelectrics. No basic superiority can be attributed to either process. The experimental program is not sufficiently well developed yet to verify any of the theoretical criteria. (auth)

34532 (BSD-TDR-63-107) THE RELATION BETWEEN BREMSSTRAHLUNG AND ELASTIC SCATTERING OF LOW-ENERGY ELECTRONS. Raymond L. Taylor and Bennett Kivel (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). May 1963. Cnntracts AF04(694)-33 and DA-19-020-ORD-5476. 5p. (AMP-112)

Recent infrared measurements of bremsstrahlung in shock-heated air and nitrogen are compared with elastic scattering cross sections for low energy electrons for molecular and atomic nitrogen and atomic oxygen. The bremsstrahlung intensity is analyzed by means of the Kramers-Unsöld expression to determine the effective coulombic charges, Z^2, for N_2, N, and O. The trend of this result is consistent with the similar trend for the elastic scattering cross sections of low energy electrons as determined from conductivity measurements in shock tubes and other measurements. This comparison suggests that the bremsstrahlung intensity is proportional to the electron scattering. (auth)

34533 (CONF-39-59) RELEASE OF FISSION PRODUCTS DURING IN-PILE MELTING OF UO_2. W. E. Browning, Jr., C. E. Miller, Jr., R. P. Shields, and B. F. Roberts (Oak Ridge National Lab., Tenn.). [1963]. Contract [W-7405-eng-26]. 37p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

A series of experiments to study the amounts and forms of fission products released during simulated reactor accidents are described. These experiments consisted of melting miniature stainless steel-clad UO_2 fuel elements in a helium atmosphere in the Oak Ridge Research Reactor and measuring the fission products released. Fission and gamma heat in the reactor raised the temperature of the miniature fuel element sufficiently high to melt the UO_2 without the use of external heat sources. In these experiments with UO_2, nearly all of the iodine, tellurium, and cesium, and more than half of the strontium, zirconium,

ruthenium, barium, and cerium were released from the fuel. Release of the latter group of fission products and uranium from a zone including the fuel and surrounding heat insulators was generally less than 3%. The minimum temperature of this zone during fuel melting was 1000°C. The retention of fission products within the high temperature zone is considered to be significant since during an actual reactor accident, temperatures corresponding to those of the high temperature zone would probably occur only within the immediate area in which the fuel is overheated. Analysis of the observed distributions of deposited fission product yields information about their behavior and form. Ruthenium follows the stainless steel cladding as it melts and vaporizes. Certain fission products are associated with millimicron sized particles of two size groups, one centered around 22 angstroms and the second around 30 angstroms in diameter. Comparisons of the fission product release values from in-pile and various out-of-pile experiments indicate that the in-pile releases are greater, probably because of more extreme temperatures. (auth)

34534 (CONF-46-84) ENERGETIC ATOM TUNNELING IN A WURTZITE STRUCTURE. J. R. Beeler, Jr. and D. G. Besco (General Electric Co. Advanced Technology Services, Cincinnati). May 8, 1963. Contract AT(40-1)-2847. 13p. (TM-63-6-5)

From the American Physical Society, 1963 Spring Meeting, Washington, D. C.

Machine calculations on the range and damage productivity of 2-kev beryllium and 6-kev oxygen atoms in BeO (wurtzite structure) were performed to estimate the effect of tunneling on these quantities. Atoms were started along various azimuthal directions in the basal plane (plane A) and a plane (plane B) midway between adjacent basal planes. The tunnel-range-to-normal-range ratio for oxygen was 12 (plane A) and 66 (plane B). In the case of beryllium, this ratio was 21 (plane A) and 32 (plane B). Tunnel-trajectory damage was less than 10% of that caused by normal trajectories. Quasitunneling behavior occurred when the oxygen and beryllium starting directions were within 10° and 25°, respectively, of a tunnel direction. Normal trajectory damage was over twice the average damage for quasi-tunnel trajectories. Tunnel trajectories were helical in form and confined themselves to a single tunnel core. (auth)

34535 (CONF-78-4) STABILITY OF A THERMIONIC ENERGY CONVERSION DIODE USING A LIQUID METAL ELECTRON COLLECTOR. A. J. Ulrich (Argonne National Lab., Ill.). [1963]. Contract W-31-109-eng-38. 9p.

From American Physical Society 1963 Summer Meeting, Buffalo, June 1963.

An investigation was conducted on the thermal conditions for the formation of a stable or unstable film boiling sheath between the electron emitter and the liquid metal pool. A diode geometry with the emitter introduced into the pool from above was used. Results are presented in the form of collector temperature-saturation temperature graphs for potassium at emitter temperatures of 2025, 2240, and 2440°K. The region of stable operation and the maximum submersion both increase with temperature. (D.L.C.)

34536 (EUR-338.e) SELF-ABSORPTION IN SOURCES OF BETA EMITTERS. G. Bertolini, G. Segre, and O. Terracini (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 18p.

A description is given of the measurements carried out to determine the self-absorption in pure beta sources. The beta efficiency, ϵ_β, was determined for E^{β}_{max} ranging from 160 to 1390 kev and source superficial density ranging from 0.05 to 0.6 mg/cm^2. Use was made of the nuclides Nb^{95}, Co^{60}, Sc^{46}, Na^{22}, Au^{198}, and Na^{22}. (auth)

34537 (HW-SA-2893A(Rev.)) THE MAGNETIC SUSCEPTIBILITY OF PROMETHIUM-147 OXIDE. J. C. Sheppard, E. J. Wheelwright, and F. P. Roberts (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [nd]. Contract AT(45-1)-1350. 5p. (CONF-157-3)

From American Chemical Society Northwest Regional Meeting, Bellingham, Wash., June 1963.

At 25° promethium-147 oxide, whose color resembles that of erbium oxide, was found by the Gouy technique to have specific susceptibility of 15.5×10^{-6} cgs units. After making an allowance for the diamagnetic contribution in the compound, Pm_2O_3, the molar susceptibility was calculated to be 2660×10^{-6} cgs units. Assuming that the ground state of Pm^{3+} is $^5I_4$ and that the multiplet intervals are large compared to kT, a molar susceptibility of 2960×10^{-6} cgs units was calculated using the familiar equation. These values are in reasonable agreement. (auth)

34538 (NP-13037) VAPOR-FILLED THERMIONIC CONVERTERS. Quarterly Report No. 3, April 1, 1963 to June 30, 1963. K. G. Hernqvist, J. R. Fendley, J. D. Levine, and F. X. Palacios (David Sarnoff Research Center, Princeton, N. J.). July 20, 1963. Contract NAS 3-2531. 8p.

Studies of hydrogen evolution in operating thermionic converters are described. It was found that hydrogen evolves from the cesium liquid used in the converters and that if the hydrogen is not removed the evolution rate is high enough to adversely affect the performance of the converter. A mechanism of hydrogen removal from converters having hot nickel anodes is proposed. Apparatus for xenon gas-dosing experiments is described. A program of fundamental adsorption physics is outlined. It is planned to extend the theoretical analysis of metallic adsorbates on metallic substrates to a system of two gases and to a system of metallic adsorbates on insulators. (auth)

34539 (NP-13044) THERMIONIC CONVERTER SURFACE CONDITIONS. Quarterly Technical Progress Report No. 2, May 1, 1963–July 31, 1963. (General Electric Co. Research Lab., Schenectady, N. Y.). Aug. 1963. Contract AF33(657)-10132. 25p.

Progress in a program to study various emitter materials and surface conditions in a plane parallel cesium vapor thermionic converter configuration is reported. The operation of a parallel-plane cesium converter with an emitter of oxygen-treated tantalum and a collector of molybdenum was investigated. When the converter was initially operated, the output power in the lower range of emitter temperatures was higher than that obtainable after some 30 hr of operation. After 40 hr of operation at various values of emitter temperature from 1550 to approximately 2085°K, the converter apparently settled down to a stable condition of operation. A slow variation of output power with collector temperature was found to be normal. (M.C.G.)

34540 (NP-13058) ADVANCED SOLAR THERMIONIC GENERATORS. Quarterly Technical Progress Report No. 3, April–May 1963. R. R. Herrick, R. C. Keyser, and L. L. Dutram (General Electric Co. Missile and Space Div., Valley Forge Space Technology Center, King of Prussia, Penna.). June 1963. Contract AF33(657)-8947. 44p.

Fabrication of development converters, both B and C series, is outlined, noting the significant problem areas. Results of testing of the B series have given performance

up to 9.6 watts/cm^2 at 1950°K and 3.0 watts/cm^2 at 1550°K. Converter C-3 has completed a 510 hour life test, including 210 hours of thermal cycling. (auth)

34541 (NP-13063) LONG LIFE CLOSED LOOP MHD RESEARCH AND DEVELOPMENT UNIT. Interim Scientific Report No. 5, March 15, 1963 to June 15, 1963. (Westinghouse Electric Corp., Pittsburgh). June 15, 1963. Contract AF33(657)-8311. 85p.

Minor design changes were made in the closed-loop magnetohydrodynamic research unit. The bubbled zirconia material that was to be used for heat insulation of the return bends of the loop is being replaced by multiple reflection shields. This change was prompted by an incompatibility manifested between tantalum and zirconia in the presence of cesium. Studies on degradation of the tantalum components of the loop were continued. Aside from the reflection shields, all other components of the loop are ready for assembly. Operation of the loop with nonequilibrium ionization, discharge pumping enhancement, and velocity determination by time-of-flight measurements are discussed. (M.C.G.)

34542 (ORNL-3480) SOLID STATE DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING MAY 31, 1963. (Oak Ridge National Lab., Tenn.). Aug. 23, 1963. Contract W-7405-eng-26. 170p.

Progress in solid state physics is reported in the following areas: theory, crystals, metals and nonmetals, radiation effects, and other subjects. Separate abstracts were prepared for the fifteen sections of the report. A list of 70 papers and publications is included. (D.C.W.)

34543 (ORNL-3480(p.3-7)) STUDIES ASSOCIATED WITH THE THEORY OF RADIATION DAMAGE. (Oak Ridge National Lab., Tenn.).

Computer studies of the slowing down of 1 to 10-kev Cu atoms in Cu monocrystals showed that the penetrations depend on the crystallographic orientation of the incident particles. Calculations for fcc, bcc, and diamond structures all showed the importance of channeling in the slowing down. The ranges of atoms at 1 to 100 kev slowing down in a random solid were calculated with a Thomas-Fermi potential. The ranges were shorter than those for a Bohr screened Coulomb potential and gave a closer fit to experimental data. An expression was derived for the fraction of Frenkel pairs in large radiation-induced displacement cascades that are annealed by mechanical instability. Investigation of the effect of channeling on displacement cascade theory showed that the number of displacements produced by an energetic atom depends on the atom energy to some power less than one. The range distribution of energetic atoms traveling along channels between atomic chains in crystals was calculated analytically. Numerical results for Cu atoms in Cu are given. The classical small-angle scattering for repulsive central potentials was treated as a perturbation problem. (D.C.W.)

34544 (ORNL-3480(p.8-10)) THEORY OF ELECTRON STATES. (Oak Ridge National Lab., Tenn.).

The shift of the Fermi level of a metal by a large magnetic field, and the resultant change in the magnetic susceptibility, were calculated. It is shown that the effect may be observable in Bi in a 100 kgauss field. A new type of degeneracy of energy surfaces was found to arise for certain arrangements of points of the boundary of an extended Brillouin zone. Well-correlated wave functions were used to calculate the hyperfine interaction in atomic Li quite well. The usual interpretation of the results obtained for Li with the Hartree-Fock method was concluded to be not entirely acceptable. (D.C.W.)

34545 (ORNL-3480(p.11-13)) STUDIES ON DEFECTS IN IONIC CRYSTALS. (Oak Ridge National Lab., Tenn.).

The electronic structure of the F-center was studied to determine if bound states other than the two responsible for the main F-band exist. The F-center electronic wave function was expressed as a linear combination of atomic orbitals of the alkali ions. Excited states of symmetries other than that usually associated with optical transitions were found for LiCl. The K-band was not found. The Heitler-London method was used to calculate the electronic properties of the M-center in LiCl. The calculations gave the band separations quite well and indicated that M-centers can be formed more easily from F-centers if at least one F-center is in an excited state. (D.C.W.)

34546 (ORNL-3480(p.17-28)) X-RAY DIFFRACTION. (Oak Ridge National Lab., Tenn.).

Photographs of anomalous x-ray transmission in nearly perfect Cu crystals up to 1.3 mm thick revealed individual imperfections. A vertically rotating double crystal x-ray spectrometer capable of measuring diffraction line widths to tenths of a sec was developed and used to measure line half-widths as small as 3.0 sec in Cu. The results agree with predictions of the Darwin theory for a perfect crystal. Annealing the ORNL Graphite Reactor moderator successfully removed much of the stored energy (data are given). (D.C.W.)

34547 (ORNL-3480(p.29-34)) ELECTRON MICROSCOPY. (Oak Ridge National Lab., Tenn.).

The investigation of fission tracks in UO_2 single crystals revealed that track registration results from diffraction contrast effects and occurs only in the crystal surface region. Fission track registration was found not to occur in Au and Pt films at thicknesses greater than 100 Å. Irradiation of Cu–15 at. % Al foils produced no detectable structures. Expressions were derived for the number of particles of deposit formed during condensation of a vapor onto an inert substrate, and an expression for the epitaxial temperature for formation of thin Ge films on single crystal substrates was shown to agree with experimental data. (auth)

34548 (ORNL-3480(p.35-40)) SPIN RESONANCE. (Oak Ridge National Lab., Tenn.).

The temperature dependence of the spin-lattice relaxation time of the E_1' and E_2' centers in synthetic quartz was measured from 250 to 1.3°K at 3 kgauss. The Raman relaxation shows a temperature variation of about T^9, much slower than expected from theory. The observation of a hyperfine interaction with a paramagnetic center in Co^{60} gamma-irradiated synthetic quartz was found to occur when the quantizing field at the nucleus, from which the interaction arises, is the laboratory field and not the field due to the paramagnetic center. Additional support for the hypothesis that the polarization currents in several glasses are ohmic in character was obtained, and the peak in the enhancement of the polarization currents as a function of gamma dose was verified. The peak is, seemingly, primarily due to those polarization processes with the largest characteristic times. (D.C.W.)

34549 (ORNL-3480(p.41-5)) SUPERCONDUCTIVITY. (Oak Ridge National Lab., Tenn.).

Anomalous longitudinal critical currents were observed in several cold-draw superconducting alloys. A single-layer force-free toroid was constructed on the basis of this data, but the results were inconclusive. Helical current flow is suggested to explain the critical-current behavior. A uniform-field superconducting magnet with a maximum field of 11 kgauss was built for low-temperature magnetic

measurements. Magnetization curves obtained for superconducting lead, Pb–Tl, and Nb–Zr showed strong hysteresis. Critical current behavior in Nb–Zr alloys and in small solenoids in external fields was also studied. (D.C.W.)

34550 (ORNL-3480(p.49-56)) INVESTIGATIONS OF METAL SURFACES. F. W. Young, Jr., L. D. Hulett, et al. (Oak Ridge National Lab., Tenn.).

The growth direction of Cu crystals grown by the Bridgman technique was random for identical growth conditions, but the dislocation density was an inverse function of the angular deviation of the growth direction from the 111 zone. Effects of thermal stresses during both seeded and unseeded growth were studied. An anomalous transmission x-ray topograph of a Cu crystal was obtained. Crystal preparation and results and conclusions from the experiment are discussed. The possible role of crystal imperfections, particularly dislocations, in the nucleation of steps was studied along with the kinetics of growth of etch pits at dislocations on (111) surfaces. The results were interpreted in terms of kinematic dissolution theory. The effects of crystal geometry on the formation and motion of ledges on Cu surfaces 0 to 2° removed from the 111 were investigated. Preliminary results on the effects of solution composition and dissolution rate are included. The influence of current density, solution composition, and slight misorientations of the surface from the 111 on the formation of etch pits at dislocations was examined, and equilibration experiments were conducted to explain the development of facets on only a portion of a spherical crystal exposed to Cu-carrying solutions. Anodic dissolution of Cu single crystals in solutions containing Cu was studied. Current and potential relations are used to explain the roles of iodide and bromide in the formation of etch pits on the 111 and also to determine exchange current densities on various orientations. (D.C.W.)

34551 (ORNL-3480(p.57-64)) LOW-TEMPERATURE IRRADIATION STUDIES. R. R. Coltman, C. E. Klabunde, et al. (Oak Ridge National Lab., Tenn.).

The low-temperature irradiation facility at the Bulk Shielding Reactor neared completion. Components, systems, and tests are discussed. The thermal neutron flux was measured to be 2.5×10^{12}/cm/sec, and the heat capacity of the refrigeration system is at least 20 w at 3.6°K. Thermal conductivity measurements revealed considerable recovery below room temperature in BeO after neutron irradiation at 100°K. (D.C.W.)

34552 (ORNL-3480(p.65-71)) ELASTICITY AND ANELASTICITY STUDIES. (Oak Ridge National Lab., Tenn.).

The amplitude dependence of internal friction in irradiated Cu was measured to obtain information on the stress necessary to break dislocations away from radiation defect pinning points. The dose dependence of the breakaway stress was found to be similar to the dose dependence of radiation hardening. Also, a technique was developed for observing third-order elasticity in solids. A large-amplitude ultrasonic wave is propagated in the sample. Because of the non-Hookes'-law nature of the medium at finite amplitudes, harmonics of this wave are generated as the wave progresses. The fundamental and second harmonic components in polycrystalline Al were measured. (D.C.W.)

34553 (ORNL-3480(p.72-5)) Ar^+ ION BOMBARDMENT OF METAL SURFACES. A. L. Southern and D. R. Burrowbridge (Oak Ridge National Lab., Tenn.).

The sputtering yields of additional orientations of Cu monocrystals were determined. Atom-ejection patterns were obtained for the three low-index planes of Cu_3Au and for Cd and Mg. Patterns obtained from either Cd or Mg did not show structure. A dual-beam mass spectrometer was installed, and energy and mass analyses were conducted on the cations ejected from two Cu monocrystals. (D.C.W.)

34554 (ORNL-3480(p.79-94)) SEMICONDUCTOR STUDIES. (Oak Ridge National Lab., Tenn.).

The apparent p-type carrier concentration and acceptor level position of Co^{60} photon-irradiated Ge samples were shown to depend on the number of fast-neutron-induced disordered regions. The ratios of the calculated to the observed lattice-defect introduction rates for several semiconductors were compared for different photon energies. The experimental and theoretical agreement increased with photon energy. The apparent rate of introduction of lattice defects in Ge and Si was obtained after thermal, fission spectrum, and monoenergetic neutron irradiations. The 0.09-ev level that appears in γ-irradiated Ge upon annealing appeared to be connected with an oxygen-vacancy complex. The rate of defect production in γ-irradiated n-type Ge was found to be a function of the impurity concentration. The analysis of the annealing kinetics of γ-irradiated n-type Ge was extended. An activation energy for vacancy motion of 0.75 ev and a binding energy for the SbV complex of 0.55 ev were obtained. The apparent removal rate of conduction electrons in n-type CdS was obtained as a function of Co^{60} photon and thermal-neutron irradiations. In undoped CdS crystals, Co^{60} γ rays produced a carrier introduction rate of 0.006 electron/absorbed photon as well as a marked increase in photoconductivity. Hall data indicate that a number of shallow levels probably account for these effects. Arsenic-doped Ge was shown to develop minority carrier traps on annealing after Co^{60} gamma irradiation. Annealing of both minority carrier traps and recombination centers was studied. Radiation-induced trapping levels in Ge were investigated by low-temperature photoconductivity measurements. Studies of radiation-produced net acceptor levels in the forbidden gap of Si are also discussed. (D.C.W.)

34555 (ORNL-3480(p.95-107)) INSULATING CRYSTALS. (Oak Ridge National Lab., Tenn.).

The study of the intensity dependence of F-center production by accelerator electrons gave evidence that a dynamic equilibrium exists between F- and M-centers in KCl and that this equilibrium is established rapidly with reference to the time scale of actual production of color centers. Studies on F- and M-band introduction in KCl by ionizing radiation showed that late-stage coloring properties vary greatly among crystals obtained from various commercial sources. The effect of heat treatment and irradiation on the mechanical properties of KCl single crystals of varying impurity concentrations was investigated, and the flow stress and F-band coloration at room temperature of several KCl samples were measured as a function of gamma and electron irradiation. Light scattering techniques were used to determine the character of the dominant scattering units in KCl and their size, shape, and concentration. It was found that for Harshaw and Isomet KCl the scattering is from impurity clouds surrounding edge dislocations and that these cylindrical scattering units have a length of about 3×10^{-4} cm and a radius of less than 2.5×10^{-6} cm. (D.C.W.)

34556 (ORNL-3480(p.108-14)) PURE MATERIALS PROGRAM. (Oak Ridge National Lab., Tenn.).

The growth of single crystal HgS from the melt under He pressure was studied. Gamma irradiation of Bi_2Te_3 was found to produce, apparently, Te vacancies and interlaminar clusters of Te interstitials. Evidence of an effect on impurity band conduction at low temperature was also observed. Vapor-crystalline studies indicate that the nonstoichiometric doping mechanism in Bi_2Se_3 is subtractive in nature (i.e., Se atoms occupy normal Se sites, but some Bi sites are vacant). A procedure that uses magnetic susceptibility measurements to assay the excess oxygen content in Cu_2O was developed and tested with promising results. The preparation of pure KCl single crystals was studied; results of analyses on samples and commercial crystals are included. (D.C.W.)

34557 (ORNL-3480(p.117-42)) RADIATION METALLURGY. (Oak Ridge National Lab., Tenn.).

Radiation embrittlement of reactor pressure vessels was examined, and the mechanical properties of Ni under irradiation were studied. Sheet tensile samples of type 330 Ni alloy were irradiated in a partial fuel element in the Oak Ridge Reactor. Measurements after irradiation indicated an increase in the yield stress and ultimate tensile stress and a decrease in the elongation. Also, a yield point was induced, and the rate of work hardening was decreased. In-pile stress-rupture tests were performed on Inconel 600, 304 stainless steel, Zircaloy-2, Nb–Zr alloy, and ASTM A212B pressure-vessel steel. Neutron irradiation effects on the mechanical properties of Fe and Fe-base alloys were also investigated. A flexure pendulum apparatus was developed and used to measure the internal friction of Fe–N during reactor irradiation. Atomic rearrangements in Cu–Ni alloys were studied. The flux and temperature dependence of the radiation-enhanced ordering in Al–Cu was measured for freshly prepared and thermally cycled samples. The results were analyzed in terms of the theory of radiation-enhanced diffusion. The theory of diffusion, with special emphasis on the freezing-in problem and on radiation-enhanced diffusion was also examined. The theory was compared with recent experimental work on the effect of radiation on ordering reactions in alloys. (D.C.W.)

34558 (RISÖ-53) DETERMINATION OF BEAM PARAMETERS AND MEASUREMENTS OF DOSE DISTRIBUTION IN MATERIALS IRRADIATED BY ELECTRONS IN THE RANGE OF 6 Mev TO 14 Mev. Ari Brynjólfsson and Gunnar Thaarup (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Apr. 1963. 31p.

The geometry, the energy, and the energy distribution of the bent beam of the Danish 10-Mev Linear Electron Accelerator were determined. The scanner homogeneity and the scattering in the 0.4 mm thick Al output window were examined, and a dose calibration of the machine running at constant output conditions was carried out. The dose distribution in thick samples of water, perspex, Al, Fe, and Cu was measured in the energy range of 6 to 14 Mev and in a broad beam geometry. Effects of electron reflectors surrounding the sample were studied. Dose distribution near the boundaries of the samples is given. (auth)

34559 (RM-3748-PR) ENERGY LEVELS, PARTITION FUNCTIONS AND FRACTIONAL ELECTRONIC POPULATIONS FOR NITROGEN AND OXYGEN ATOMS AND IONS TO 25,000°K. F. R. Gilmore (RAND Corp., Santa Monica, Calif.). Aug. 1963. Contract AF49(638)-700. 44p. (AD-413068)

Energy levels for N, N^+, N^{2+}, N^{3+}, O, O^+, O^{2+}, and O^{3+} are tabulated for all possible electronic states or groups of states having two electrons in the n = 1 shell, one electron in the n = 2 to 8 shell, and the remaining electrons in the n = 2 shell. The corresponding partition functions and fractional populations for each electronic state of these species were calculated on an IBM 7090 and are reported for 34 temperatures between 1000 and 25,000°K. Alternate partition functions including only electronic states out to n = 4 are also tabulated. (auth)

34560 (TID-19195) LINEAR ACCELERATOR PROJECT. Annual Technical Report, FY 1963. (Rensselaer Polytechnic Inst., Troy, N. Y.). Contract AT(30-3)-328. 79p.

The Linac was operated for about 2400 hours of beam time, and a wide range of experiments was carried out using the accelerator. Parallel activity was conducted in theoretical reactor physics research. Experiments included the effect of kernels on die-away parameters, effective mass kernels in neutron thermalization, modified P-2 approximation for disadvantage factors, thin-region parameters, time-dependent neutron spectra, time dependence in small geometries, spectra in pulsed fissionable assemblies, low-energy neutron inelastic scattering program, chopper program, filter detector, fission cross section of Pu^{241}, capture-to-fission ratio of U^{235}, neutron capture-cross-section measurements, polarization of neutrons from the photodisintegration of deuterium, diffusion parameters of water, asymptotic spectrum measurements in polyethylene, the effects of coherent scattering on the thermalization of neutrons in beryllium, multiplying medium asymptotic spectrum measurement, and photonuclear investigations. (M.C.G.)

34561 (WANL-TNR-063) ACTIVATION SOURCE STRENGTH PROGRAM. ACT-I FOR THE IBM 7090 COMPUTER. P. C. Heiser and L. O. Ricks (Westinghouse Electric Corp. Astronuclear Lab., Pittsburgh). Sept. 1962. Contract AT(30-1)-3108. 41p.

Act-I provides gamma radiation sources in four groups, from neutron activation, for use in radiation level and shielding calculations (e.g. by Program 14-0 or hand). The program is coded for a 32K IBM-7090 computer and requires a running time of about 1.5 minutes for 10 elements and 50 time print outs. The program accurately predicts the source for thin regions and infinitely dilute elements in a moderator but overestimates the source for penetrations greater than two neutron capture mean free paths. (auth)

34562 (WANL-TNR-063(Add.1)) ACTIVATION SOURCE STRENGTH PROGRAM. ACT-II. P. C. Heiser and L. O. Ricks (Westinghouse Electric Corp. Astronuclear Lab., Pittsburgh). [nd]. Contract AT(30-1)-3108. 36p.

Activation Source Strength Program Act-I was modified to allow adjustment for neutron self-shielding, finite dilutions, or thick regions, and several print-out options. The modified program is designated Act-II. Act-I calculates the gamma energy emission source strength (Mev/cc-sec) in 4 energy groups for materials containing up to 44 specified elements as a function of neutron exposure and decay time for thin or infinitely dilute materials. In addition to the provisions of Act-I, Act-II allows the input of removal cross sections for neutron flux groups 1 thru 4 and factors to adjust the group 3 and 4 resonance region cross sections. These adjustments extend the accurate usefulness of the program to regions several neutron relaxation lengths in thickness, accounting for about 95 to 99% of the induced activity. The principle print-out options allow the selection of peak or thickness averaged source strengths and printing only the sources summed for each element rather than each isotopic reaction. In either case, the total energy emission is summed for each element and the alloy. (auth)

34563 (AERE-Trans-951) THE PART PLAYED BY CASCADE TRANSITIONS IN THE EXCITATION OF HELIUM LINES. V. E. Yakhontova. Translated by M. Archer (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Vestn. Leningr. Univ., No. 10, Ser. Fiz. i Khim., No. 2, 27-42(1959). 19p.

The results of the measurements of the excitation functions and of the maxima of the effective cross-sections for the excitation of thirteen helium lines are given. The improved conditions of the experiments, a considerable increase in the homogeneity of the exciting electron beam and accurate photoelectric recording, made it possible to reveal new details in the form of the line excitation functions. Some new conclusions regarding the form of the excitation functions of helium levels are made. Cascade transitions are shown to contribute heavily to the excitation functions. (auth)

34564 (FTD-TT-63-351) EFFECT OF A MAGNETIC FIELD ON PHENOMENA IN A DIODE WITH CESIUM VAPORS. N. D. Morgulis and Yu. I. Chutov. Translated from Ukr. Fiz. Zh., 7: 1003-12(1962). 16p.

The effect of a magnetic field on an electron short circuit stream and on the entire stream was investigated in a decelerating electric field in a diode with cesium vapors as a close model of a thermoelectron transformer. The equipment and procedure are described, and the results are interpreted. (auth)

34565 INVESTIGATIONS IN RELATIVISTIC COSMOLOGY. E. M. Lifshitz and I. M. Khalatnikov (Inst. for Physical Problems, Academy of Sciences, Moscow). Advan. Phys., 12: 185-249(Apr. 1963). (In English)

A detailed report is given of the general investigations carried out in the field of relativistic cosmology during the past years. A study of the singularities of the cosmological solutions of the gravitational equations is presented. An attempt is made to provide an answer to one of the principal questions of modern cosmology: "does the general solution of the gravitational equations have a singularity?" A negative answer is given to this question. The study carried out leads, in fact, to the general conclusion that the presence of a singularity with respect to time is not a necessary property of cosmological models of the general theory of relativity, and that the general case of an arbitrary distribution of matter and gravitational field does not lead to the appearance of a singularity. This result, however, does not exclude the possibility of the existence of more restricted classes of cosmological solutions of the gravitational equations that possess a true singularity. The search for such solutions gives reasons to believe that the possible types of such solutions are exhausted by those to which one is naturally led by the arguments given. As far as the solution corresponding to the real universe is concerned, its choice is connected with some deep physical requirements, which cannot be established on the basis of only the existing theory of gravitation. Only after establishing these requirements could it be determined whether or not the solution that satisfies them possesses a singularity. An investigation of the gravitational stability of the isotropic model is presented. There are grounds to believe that this model gives an adequate description of the present-day state of the universe considered on a large scale. The behavior in time of various kinds of small perturbations to the isotropic model is studied. It is shown that perturbations that do not disturb the uniformity of the distribution of matter are either damped with time or remain constant. Perturbations that involve changes in the density of matter behave differently in expanding and contracting universes. In an expanding universe the changes in the density of matter grow slowly with time for long wavelength perturbations and decrease, with time for short wavelength perturbations. The contracting universe, however, is essentially unstable against such perturbations. The entire study is carried out on the basis of the Einstein equations in their classical form, without the cosmological term, in which form they follow logically from the general foundations of the theory of relativity. (auth)

34566 APPARENT THERMAL EMISSIVITY FROM SURFACES WITH MULTIPLE V-SHAPED GROOVES. John Psarouthakis (Martin Marietta Corp., Baltimore). AIAA (Am. Inst. Aeron. Astronaut.) J., 1: 1879-82(Aug. 1963).

Experimental and analytical results on thermal emissivity from metallic surfaces with multiple V-shaped grooves are presented. The radiant interchange within an infinitely long V-shaped groove is studied, and its apparent thermal emissivity is found as a function of the included angle and the emissivity of the surfaces including the angle. The view factor and the apparent emissivity are plotted for various angles vs. the surface emissivity. The experimental results for a 30° included angle are in agreement with the analysis. It is found that, with an included angle of 30° and surface emissivity of 0.3, an apparent emissivity of 0.64 can be obtained. Experimental measurements of the total thermal emissivity of a ground molybdenum surface at various temperatures also are presented. A discussion on actual application of grooves on radiating surfaces and the effects of imperfections present in the grooves due to cutting processes is given. (auth)

34567 FORCES AND FIELDS IN SPECIAL RELATIVITY. W. P. Ganley (Bryn Mawr Coll., Penna.). Am. J. Phys., 31: 510-16(July 1963).

Two examples of force transformations applied to electromagnetic systems are described in detail, along with an elementary derivation of the force transformation laws that requires no formal calculus. (auth)

34568 ELECTRIC FIELD OF A CHARGE MOVING IN A MEDIUM. G. M. Volkoff (Univ. of British Columbia, Vancouver). Am. J. Phys., 31: 601-5(Aug. 1963).

An apparent difficulty in applying Gauss' theorem to the classical electric field associated with a charge moving in an infinite homogeneous nondispersive medium with a constant velocity exceeding the velocity of propagation of light in the medium is clarified. This is done by investigating the behavior of the electric field intensity not only inside the cone defining the region that can be reached by light signals from the charge but also on the cone. (auth)

34569 PROPERTIES OF THE HYDROGEN MASER. Daniel Kleppner, H. Mark Goldenberg, and Norman F. Ramsey (Harvard Univ., Cambridge, Mass.). Appl. Optics, 1: 55-60(Jan. 1962).

Properties of the hydrogen maser and details of the apparatus are discussed. Experimental work is described which yields a new value for the hyperfine separation of hydrogen in its ground state. The result is $\Delta\nu$ = 1,420,405,762 ± 4 cps. This result is based on a value of the hyperfine separation in Cs^{133} that is taken to be $\Delta\nu(Cs^{133})$ = 9,192,631,840 cps. (auth)

34570 A METHOD FOR OBTAINING ACCURATE HALF-INTENSITY WIDTHS OF SPECTRAL LINES PHOTOGRAPHED IN THE VACUUM ULTRAVIOLET. B. B. Jones (United Kingdom Atomic Energy Authority, Culham, Oxfordshire, Eng.). Appl. Optics, 1: 239-42(May 1962).

A method was developed for finding the half-intensity width, to an accuracy of ±5%, of the profiles of spectral lines photographed in the vacuum ultraviolet. Plate calibration is achieved by an aperture restriction device placed at the Sirks focus of a 3-meter normal incidence vacuum spectrograph. This gives a stepped intensity in the focal plane with a standard ratio of 2:1. The measurement is not affected by reciprocity law failure or intermittency effect in the photographic emulsion, and can be used with pulsed light sources. (auth)

34571 SPECTROSCOPY FOR SOLID-STATE OPTICAL MASERS. Satoru Sugano (Bell Telephone Labs., Murray Hill, N. J.). Appl. Optics, 1: 295-301(May 1962).

A brief account is given of the spectroscopy of excitation processes in semiconductors, rare earth ions, transition metal ions, and actinide group ions in ionic crystals, from the standpoint of applying solid-state optical spectra to optical masers. (auth)

34572 STIMULATED EMISSION OF INFRARED RADIATION FROM YTTERBIUM ACTIVATED SILICATE GLASS. H. W. Etzel, H. W. Gandy, and R. J. Ginther (Naval Research Lab., Washington, D. C.). Appl. Optics, 1: 534-6(July 1962).

The stimulated emission of Yb^{3+} in a lithium–magnesium–alumino–silicate glass that was made to oscillate at a wavelength of 1.015 μ at liquid N temperature and lower is described. A Xe-filled helical flashtube was used as the optical pumping source. The lifetime for spontaneous emission apparently is at least as long as the rise time of the source. Variation of the emission with temperature was noted, and the peak power density was about 12 w/cm^2. Absorption bands at 914, 946, and 976 mμ apparently give most of the laser action, although bands at 310 and 220 mμ were present. The overall emission bandwidth was about 6 mμ with a shortest wavelength line at 1.0125 μ, while the longest wavelength line was at 1.0184 μ. (D.C.W.)

34573 PHOTOELECTRON ENERGY DISTRIBUTION MEASUREMENTS FOR 10 TO 50 ev PHOTONS WITH A PLANAR ANALYZER AND ELECTRON MULTIPLIER. L. Heroux and H. E. Hinteregger (Air Force Cambridge Research Labs., Bedford, Mass.). Appl. Optics, 1: 701-7 (Nov. 1962).

A windowless detector for use in the extreme ultraviolet (EUV) that combines a planar retarding potential analyzer with an electrostatic electron multiplier is described. Data obtained with this detector on the normal energy distribution of photoelectrons emitted from a tungsten cathode for radiation between 256 and 1216 Å are presented. The use of the detector for limited spectral resolution in the EUV also is discussed. (auth)

34574 ENERGY STORAGE FOR HIGH-POWER DISCHARGES. Pieter R. Wiederhold. Astronaut. Aerospace Eng., 1: No. 4, 104-6(May 1963).

Energy storage systems capable of supplying high-intensity, pulse power discharges are considered. Properties of dielectric materials for capacitive devices and inductive devices using superconducting coils are investigated. (C.E.S.)

34575 ERRORS IN HELIUM VAPOUR PRESSURE THERMOMETRY. H. Montgomery and G. P. Pells (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Brit. J. Appl. Phys., 14: 525-6(Aug. 1963).

An experiment which shows that a He^4 vapor pressure bulb gives a falsely high measure of temperature below 2.2°K owing to the Kapitza resistance at the solid-liquid interface is described. Means of avoiding this error are discussed. (auth)

34576 DISCUSSION OF THE FIRST ORDER PERTURBATION CALCULUS FORMULAE IN CONNECTION WITH THE PROBLEM OF A CORRECT TRANSITION FROM DIRAC TO PAULI THEORY. W. Hanus (Copernicus Univ., Torun, Poland). Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 11: 341-5(1963). (In English)

The canonical transformation that was previously proposed to eliminate the difficulties associated with the traditional transition from Dirac to Pauli formalism is investigated. This transformation was defined by the separation of the hermitian and antihermitian parts and resulted in hamiltonians that were not entirely correct. Perturbation calculus formulas based on the corrected hamiltonian were derived and their implications discussed. (C.E.S.)

34577 NOISE SPECTRA IN A LOW PRESSURE ELECTRODELESS DISCHARGE IN AIR AND THE INFLUENCE OF IRRADIATION. M. G. Kelkar (Vidarbha Mahavidyalaya, Amravati, India). Indian J. Pure Appl. Phys., 1: 220-3(June 1963).

Measurements were made of the low frequency noise spectrum of an electrodeless discharge in air at low pressures (1–10 mm Hg). The spectrum is found to be continuous and its character is markedly dependent on the applied a-c voltage and the type of coupling used. The radiation is caused mainly due to sudden burst of current at breakdown in each half cycle of the exciting voltage. At higher voltages a broad maximum is also observed near 300 kc and is probably due to oscillations of trapped positive ions in the potential minimum region of the discharge. The automatic modulation of the radiation is characterized by a fundamental tone, rich in harmonics and sounding like a deep buzz, which can be heard on any receiver. The origin of this modulation as well as the effect of irradiation on both the peak noise amplitude and the audio modulation are discussed. (auth)

34578 A STEADY FLOW OF CONDUCTING GAS IN MAGNETOHYDRODYNAMIC GENERATOR. A. V. Gubarev, V. I. Kovbasyuk, S. A. Medin, A. E. Sheindlin, and B. Ya. Shumyatskii. Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Mekhan. i Mashinostr., No. 3, 3-8(May-June 1963). (In Russian)

One-dimensional steady flow in a magnetohydrodynamic generator channel was studied, considering factors affecting electric efficiency and magnetic field induction along the length. The problem was resolved for the case in which an ideal, non-viscous, gas is electrically neutral, even near the electrodes, and the secondary magnetic field is negligible in comparison to the external field. The conductance is constant and isotropic, moreover, the potential difference on the electrodes is constant ($v = \varphi_+ - \varphi_- = \text{const}$). (R.V.J.)

34579 VIRIAL COEFFICIENTS FOR SQUARE-WELL POTENTIALS. E. Hiis Hauge (Norges Tekniske Hogskole, Trondheim, Norway). J. Chem. Phys., 39: 389-90(July 15, 1963).

Part of the fourth virial coefficient, $D_2(T,\lambda)$, was calculated with square-well potential in the region $1 \leq \lambda \leq 2$. The location of the singularities in ring integrals as functions of λ is discussed. (auth)

34580 INTERACTIONS IN POLAR MEDIA. II. CONTINUA. R. A. Marcus (Brookhaven National Lab., Upton, N. Y. and Polytechnic Inst. of Brooklyn). J. Chem. Phys., 39: 460-9(July 15, 1963). (BNL-6557)

It is shown that the electronically polarizable continuum model of a particle satisfies the equations previously de-

rived, after suitable choice of operator A_1 appearing there. The proof is given for the case where the system is regarded as composed of particles and treated statistically mechanically. It is also given for the case where several particles receive special attention and the remainder of the system (the medium) is treated as an orientationally and electronically polarizable continuum. For the second case it was necessary to extend the results previously derived so as to include several particles in the presence of the above medium and to compute the free energy of such systems. Calculations are given for media possessing equilibrium and nonequilibrium dielectric polarization. It follows from the foregoing proofs that a wide variety of models assumed in the literature for treating polar interactions are special cases of the model and of the extension to particle-medium systems. Electrode systems, for example, are included, even when the electrode is treated in the usual dielectric continuum manner. The relation and relative merits of the two models for the induced charge distribution that are standard in the literature are discussed. The models are the induced dipole and the electronically polarizable continuum. Possible direct experimental investigation of the second of these by scattering experiments is examined. (auth)

34581 RESOLUTION OF EXACT H_2^+ WAVEFUNCTION ON ONE-CENTER HYDROGENIC BASIS. Seth Boorstein and Jerry Goodisman (Harvard Univ., Cambridge, Mass.). J. Chem. Phys., 39: 479-85(July 15, 1963).

The ground state of H_2^+ was treated by a variational procedure, using as basis functions discrete hydrogen-like orbitals located at the midpoint. The variational coefficient for each function was compared to its overlap with the exact function. The effect of using different Z's for the basis sets was studied. When the basis set is not well chosen, the variational coefficients may differ radically from the values determined by the overlaps. The nodal properties of the basis functions, rather than their energies, are emphasized. (auth)

34582 SHOCK-WAVE STRUCTURE IN A PARTIALLY IONIZED GAS. M. S. Grewal and L. Talbot (Univ. of California, Berkeley). J. Fluid Mech., 16: 573-94(Aug. 1963).

The structure of a shock wave in a partially ionized gas, which may be in thermal non-equilibrium ahead of the shock wave, is investigated. A method is developed to solve this problem by separating it into two parts. First, the structure of the shock wave associated with the massive particles, ions and atoms, is assumed to be of the Mott-Smith form. Then the behavior of the electrons as they pass through this shock is analyzed. Using this method, calculations are carried out for shock waves at several Mach numbers and several values of the electron-ion temperature ratio ahead of the shock. An essential feature of the shock profiles is found to be the existence of a broad zone of elevated electron temperature ahead of the electron compression region, caused by the high thermal conductivity in the electron gas. (auth)

34583 STIMULATED EMISSION OF MAGNETIC DIPOLE RADIATION IN ELECTRIC DISCHARGES. P. J. Walsh and G. E. Courville (Fairleigh Dickinson Univ., Teaneck, N. J.). J. Opt. Soc. Am., 53: 1043-6(Sept. 1963).

The possibility of producing stimulated magnetic dipole radiation in the near-infrared region in electric discharges, due to quite large naturally occurring inversion found in electric discharges in gases possessing a metastable state lying above a radiating state to which it can radiate by a magnetic dipole transition is examined. The heavier rare gases and the heavier alkaline earths, especially mercury, offer attractive possibilities. Population measurements of Koedam and Kruithof in mercury, and the simplified calculation presented here, indicate that the required inversions in mercury are within reach. (auth)

34584 THE EQUATIONS OF SUPERCONDUCTIVITY. J. Hoegaasen-Feldman (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). J. Phys., 24: 293-6 (May 1963). (In French)

The equations defining the Bogolyubov-Valatin transformation are studied. They present an analogy with a problem in classical electrostatics. The existence and uniqueness of solutions are assured for the case of a separable pairing force. In the case of closed shells, and with a coupling constant whose absolute value is less than a certain critical value, the solution coincides with the trivial solution, and therefore it is not possible to define a system of quasi-particles. (auth)

34585 NUCLEAR MAGNETIC RELAXATION IN TRANSITION METALS. Yukio Obata (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Phys. Soc. Japan, 18: 1020-4(July 1963).

Nuclear magnetic relaxation rates due to dipolar and orbital interactions are calculated for cubic metals with partly filled p or d-bands, using the tight-binding approximation. For p-band metals the ratio of two relaxation rates is 3 : 10. For d-band metals this ratio is a function of the degree of admixture of Γ_5 and Γ_3 atomic functions at the Fermi surface. It is shown that the orbital relaxation mechanism is almost always more effective than the dipolar one. (auth)

34586 BAND THEORETICAL INTERPRETATION OF NEUTRON DIFFRACTION PHENOMENA IN FERROMAGNETIC METALS. Takeo Izuyama, Duk-Joo Kim, and Ryogo Kubo (Tokyo Univ.). J. Phys. Soc. Japan, 18: 1025-42(July 1963).

Although the neutron diffraction phenomena in ferromagnetic transition metals were successfully treated in terms of the localized spin model, this may not be regarded as a proof of the unique validity of such a model. If the correlation effect of electrons is taken into consideration by a ladder approximation, the itinerant electron model is shown to be capable of accounting for the observed diffraction equally well. The complex dynamical susceptibility is calculated with simple assumptions and the space-time correlation function of spin density is obtained from it by means of the fluctuation-dissipation theorem. The cross section for neutron scattering derived from the correlation function explains the magnetic diffuse scattering below T_c, the magnetic critical scattering around T_c, and the paramagnetic scattering above T_c. Existing data are not enough in order to discriminate between the localized and itinerant models. (auth)

34587 RAYLEIGH-TAYLOR INSTABILITY OF A VICOUS ELECTRICALLY COUNTING FLUID IN THE PRESENCE OF A HORIZONTAL MAGNETIC FIELD. A. S. Gupta (Indian Inst. of Tech., Kharagpur, India). J. Phys. Soc. Japan, 18: 1073-82(July 1963).

The initial manner of development of an infinitesimal disturbance of a plane horizontal layer of a viscous, perfectly conducting, incompressible fluid of variable density in the presence of a horizontal magnetic field is discussed. It is found that when the coefficient of viscosity μ_0 be such that $d^2\mu_0/dz^2 < 0$, instability might arise in the form of oscillation with increasing amplitude i.e., overstability. This shows that contrary to the usual role of viscosity as a damping factor, it may sometimes act as a destabilizing agent. Furthermore,

it is seen that a sufficiently strong magnetic field may stabilize a potentially unstable configuration. (auth)

34588 PRODUCTION OF CONTINUOUS HIGH-CURRENT DISCHARGES IN GASES. J. E. Allen and F. Magistrelli (Euratom-CNEN, Rome). Nature, 194: 1167 (June 23, 1962). (EUR 317.e)

Experiments were carried out to utilize the properties of a mercury pool to obtain a high electron current which is then sent into a gas other than mercury. This was done by introducing helium into a mercury vapor discharge tube in which a cold trap prevents the mercury from entering the part of the tube that contains the anode. (M.C.G.)

34589 SECONDARY ELECTRON EMISSION OF EVAPORATED TITANIUM FILMS. L. Holland and L. Laurenson (Edwards High Vacuum, Ltd., Crawley, Sussex, Eng.). Nature, 199: 274(July 20, 1963).

The secondary electron emission coefficient δ of evaporated titanium films was measured at target voltages between 0 and 1875 v with electron current densities ranging between 2 and 50 $\mu a/cm^2$. The bias voltage applied to the secondary electron collector was between 0 and +12 v. The experiments were done in an ultrahigh vacuum system. Curves for δ values of evaporated titanium films under various conditions are presented. (H.M.G.)

34590 SUPERCONDUCTIVITY AND SEMICONDUCTIVITY IN COBALTITE- AND PYRITE-TYPE COMPOUNDS. F. Hulliger (Cyanamid European Research Inst., Cologne-Geneva) and J. Mueller. Phys. Letters, 5: 226-7(July 15, 1963). (In English)

Cobaltite-type compounds, which are the ternary analogs of the pyrites, are examined for their superconducting properties. A magnetic induction method was used to establish a transition to superconductivity above 1°K in six compounds. Data are given for transition temperatures and lattice constants of cobaltite- and corresponding pyrite-type phases. (R.E.U.)

34591 QUANTUM RESONANCES IN THE AMPLIFICATION OF SOUND. H. N. Spector (Case Inst. of Tech., Cleveland). Phys. Letters, 5: 233-4(July 15, 1963). (In English)

Giant quantum oscillations in the attenuation of sound by conduction electrons in the presence of a magnetic field at low temperatures were recently predicted. This is brought about when there are electrons that have a component of drift velocity in the direction of propagation of the sound wave which is equal to the sound velocity. It is shown that the giant quantum oscillations can be observed under conditions of amplification. (R.E.U.)

34592 ELECTRONIC STRUCTURE OF LIQUID GALLIUM BY POSITRON ANNIHILATION. D. R. Gustafson and A. R. Mackintosh (Ames Lab., Ames, Iowa). Phys. Letters, 5: 234-5(July 15, 1963). (IS-653). (In English)

The observation of the angular correlation of the photons produced in electron-positron annihilation is a particularly suitable method for studying the conduction electrons in liquid metals. It is a technique which can be applied to disordered systems, and the angular distribution of the photons reflects directly the momentum distribution of the electrons. Positron annihilation experiments on liquid and solid gallium indicate that the free electron model is not a satisfactory description of the liquid near its melting point. (R.E.U.)

34593 PHOTON EMISSION BY INTERACTION OF LOW ENERGY HELIUM AND NEON IONS WITH TUNGSTEN SURFACES. H. Boehmer and E. Luescher (Univ. of Illinois, Urbana). Phys. Letters, 5: 240-2(July 15, 1963). (In English)

Photon emission upon the interaction of low-energy helium and neon ions (25 to 100 ev) with a clean tungsten surface is experimentally observed. Photon emission is a process competing with Auger de-excitation and Auger neutralization. The transition probability per unit time for the radiative decay competing with Auger neutralization is given. (R.E.U.)

34594 DIFFUSION IN SUPERIMPOSED FILMS OF NORMAL METALS AND SUPERCONDUCTORS. G. J. Van Gurp (Mullard Research Labs., Salfords, Surrey, Eng.). Phys. Letters, 5: 303-4(Aug. 1, 1963). (In English)

Interactions between a superconducting and normal film for the systems Sn/Al and In/Al in which the solid solubilities are very restricted and no intermetallic compounds are known to exist so that diffusion is very unlikely were investigated. The In/Mg system with large solubilities and a number of intermetallic compounds, in which diffusion is likely, was also studied. In the former case no change in the transition temperature of the superconductor and no superconducting energy gap in the normal metal could be detected. In the latter case a marked increase in the transition temperature of the superconductor was found. (C.E.S.)

34595 THE 50 c/s CRITICAL CURRENTS OF SUPERCONDUCTORS. E. C. Rogers (B.I.C.C. Research Organization, London). Phys. Letters, 5: 317-18(Aug. 1, 1963). (In English)

Measurements of the 50-c critical current in zero magnetic field of lead, niobium, and niobium–zirconium wires of circular cross section were presented. In niobium–zirconium wires the 50-c critical current was in all cases less than that of hard-drawn niobium wire of comparable diameter. In both high-purity lead and hard-drawn niobium the 50-c critical current in zero field was proportional to the wire diameter. The supercurrent in both materials is therefore a surface current. (C.E.S.)

34596 CLASSICAL REPRESENTATIONS OF THE RESTRICTED POINCARE GROUP. P. Gulmanelli (Università, Pavia, Italy and Istituto Nazionale di Fisica Nucleare, Pavia, Italy). Phys. Letters, 5: 320-1(Aug. 1, 1963). (In English)

The classical representations of the Lie algebra of the restricted Poincaré group are considered. The algebra of the dynamical variables of a classical system is introduced and the concept of the Poisson bracket is axiomatically presented. The presentation is essentially limited to the discussion of the commutation relations and the invariants. (C.E.S.)

34597 THE APPROACH TO EQUILIBRIUM IN NONLINEAR HYDRODYNAMICS. R. J. Donnelly and K. W. Schwarz (Univ. of Chicago). Phys. Letters, 5: 322-4 (Aug. 1, 1963). (In English)

Couette laminar flow is used to study the approach to equilibrium in an unstable flow pattern. It is shown that previously derived equations for the wave number and equilibrium amplitude of the disturbances in the unstable flow are valid approximations in the non-linear Couette flow problem. (C.E.S.)

34598 A SIMPLE APPROACH TO THE SCHWARZSCHILD SOLUTION. K. -E. Eriksson and S. Yngstroem (Uppsala Univ.). Phys. Letters, 5: 327(Aug. 1, 1963). (In English)

A distinction is made between two similar methods for a simple derivation of Schwarzschild's external solution on

the basis of the equivalence principle, special relativity, and Newton's law of gravitation. One of the methods in a paper with the same title was previously abstracted in NSA (17:31165). (C.E.S.)

34599 THERMAL CONDUCTION IN LIQUID HELIUM II. II. EFFECTS OF CHANNEL GEOMETRY. C. E. Chase (Massachusetts Inst. of Tech., Lexington.). Phys. Rev., 131: 1898-1903(Sept. 1, 1963).

The critical heat-current density W_c in liquid helium II has been measured as a function of temperature in channels of various geometries. For channels of both circular and rectangular cross section W_c varies almost inversely with channel diameter, but for the same hydraulic diameter W_c is almost 25% smaller in rectangular channels. In channels with more irregular cross sections, W_c is much smaller than in cylindrical channels of the same hydraulic diameter. The hydraulic diameter is thus not a useful parameter for comparing data obtained in chennels of different shape. The temperature dependence of W_c is in all cases similar to that reported in I for a cylindrical channel, and suggests that W_c may be associated with ordinary turbulence below about 1.7°K but at higher temperatures is caused by some other mechanism. The effects of varying the channel length and shape of orifice were also studied. Shortening one of the channels to 60% of its original length had no observable effect on W_c. W_c was also unaffected by moderate changes in orifice shape, but a severe constriction apparently disrupted the subcritical flow region so completely that W_c could not be measured at all. Various theories of the origin of the critical velocity are discussed in the light of these measurements. (auth)

34600 MEASUREMENT OF ELECTRON MOBILITIES IN ARGON GAS IN A PURE VAPOR CLOUD CHAMBER. R. P. Caren (Ohio State Univ., Columbus). Phys. Rev., 131: 1904-6(Sept. 1, 1963).

Measurements were made of the mobilities of electrons in argon gas using pure vapor cloud-chamber techniques. Electron mobilities were measured in the E/P_0 range (P_0 is the pressure corrected to 296°K) from 7.9 to 11.4 v/cm mm Hg. The electron mobilities were found to be approximately constant over this E/P_0 range with a value of k_0 of about 3.0×10^5 cm^2/vsec mm Hg. (auth)

34601 HIGH-FREQUENCY CONDUCTIVITY OF DEGENERATE SEMICONDUCTORS. Amiram Ron (Princeton Univ., N. J.) and Narkis Tzoar. Phys. Rev., 131: 1943-7 (Sept. 1, 1963).

The problem of high-frequency conductivity of a degenerate semiconductor is investigated by a kinetic description. The finite duration of encounters is taken into account in a self-consistent fashion which properly includes collective effects. This treatment is an extension for quantum plasmas of the Dawson-Oberman method given for classical plasmas. (auth)

34602 MANY-ELECTRON PERTURBATION THEORY FOR NONMETALLIC LOW-DENSITY SYSTEMS. W. J. Carr, Jr. (Westinghouse Research Labs., Pittsburgh). Phys. Rev., 131: 1947-52(Sept. 1, 1963).

A perturbation theory is developed to second order for the energy of a system of weakly interacting atoms. For a large uniform system the expression is correctly proportional to the number of atoms N. The result is given as the sum of electrostatic and Van der Waals terms plus exchange effects. The exchange energy is described first in the pair approximation, followed by corrections due to electron exchange among three or more atoms in both the first and second orders of the perturbation series. The second-order exchange term is due to the effect on exchange produced by the first-order perturbation on the wave function caused by Van der Waals forces. The zeroth-order term is the energy of the isolated atoms so that in the ground state all other terms are successive corrections to the smaller binding energy. In the case where the unperturbed atoms have an angular momentum, use of degenerate perturbation theory leads to a spin-wave type of solution, with coupling between the atoms. (auth)

34603 LINE SHAPES, SATURATION BEHAVIOR, AND TEMPERATURE STUDIES IN THE NUCLEAR RESONANCE OF NICKEL. R. L. Streever and L. H. Bennett (National Bureau of Standards, Washington, D. C.). Phys. Rev., 131: 2000-9(Sept. 1, 1963).

The nuclear magnetic resonance of Ni^{61} was studied in pure nickel powders. Both natural nickel (1.25% abundant in Ni^{61}) and enriched nickel (99.9% abundant in Ni^{61}) were used. The signal observed with a circuit sensitive to the absorption of power is a combination of absorption and dispersion modes. The amount of mode mixing is found to depend on the applied rf field, ambient temperature, annealing temperature, and external magnetic field intensity. The mode mixing of the resonance is related to electronic losses in the sample. The saturation behavior of the individual absorption and dispersion modes is that of an inhomogeneously broadened line. From the saturation behavior an estimate of the enhancement of the applied rf level for nuclei in domain walls of about 7×10^3 is made. An additional broadening mechanism is observed in the enriched nickel, particularly at 77°K. Application of Redfield's theory of saturation at high rf levels leads to the conclusion that the additional broadening can be attributed to strong indirect exchange between nuclei. Frequency measurements from room temperature to 4.2°K made with a marginal oscillator in both the enriched and unenriched nickel are presented. A temperature-dependent frequency shift is found between the enriched and unenriched nickel which appears to be a maximum at about 200°K where the enriched nickel frequency is about 30 kc/sec higher. From room temperature to 536°K, frequency measurements made with super-regenerative circuits are reported. A comparison of the temperature dependence of the resonance frequency with the saturation magnetization is made. (auth)

34604 SECOND SOUND IN SOLIDS. Marvin Chester (Univ. of California, Los Angeles). Phys. Rev., 131: 2013-15(Sept. 1, 1963).

A critical frequency for thermal fluctuations is calculated above which heat transport proceeds by wave propagation rather than by diffusion. This phenomenon should occur in some dielectric solids. It is the analog of second sound in helium II. A macroscopic point of view is used which relies upon a modification in the Fourier heat equation. Some quantative results are obtained on the magnitude of this modification. (auth)

34605 MASER OSCILLATIONS AT 0.9 AND 1.35 MICRONS IN $CaWO_4:Nd^{3+}$. L. F. Johnson and R. A. Thomas (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 131: 2038-40(Sept. 1, 1963).

Maser oscillation from Nd^{3+} in $CaWO_4$ in $^4F_{3/2} \rightarrow {}^4I_{11/2}$ transitions, the terminal states lying ~4000 cm^{-1} above the ground state, and in $^4F_{3/2} \rightarrow {}^4I_{9/2}$ transitions, the terminal state lying 471 cm^{-1} above the ground state, is described. Attempts to obtain Maser oscillation at ~5 μ in transitions between ^4I multiplets were unsuccessful. It is concluded that these transitions are predominantly nonradiative. (auth)

34606 FREQUENCY-DEPENDENT RELAXATION TIME OF ELECTRON-PHONON SYSTEMS. Amiram Ron (Princeton Univ., N. J.). Phys. Rev., 131: 2041-5(Sept. 1, 1963). (MATT-188)

A derivation of the frequency-dependent relaxation time in a simple model of metal, composed of electrons and phonons, is presented. The problem is investigated by a quantum-kinetic description of the response of the electron-phonon system to an oscillating electric field. The treatment, which stems from a proper time-dependent transport equation, does not have the time scale restriction of the usual transition probability approach, and does give a proper description of the time-dependent collective effects. (auth)

34607 NEUTRON COHERENT-SCATTERING AMPLITUDES OF Ga, In, As, AND Sb. George Arnold and Norris Nereson (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 131: 2098-2100(Sept. 1, 1963). (LADC-5741)

Neutron-diffraction data obtained from the compounds GaAs, GaSb, InAs, and InSb lead to the following neutron coherent-scattering amplitudes: $f_{Ga} = (0.72 \pm 0.01) \times 10^{-12}$ cm, $f_{In} = (0.39 \pm 0.01) \times 10^{-12}$ cm, $f_{As} = (0.64 \pm 0.01) \times 10^{-12}$ cm, and $f_{Sb} = (0.54 \pm 0.01) \times 10^{-12}$ cm. The data were also used to evaluate the Debye characteristic temperature for the compounds in use; the resulting Debye temperatures are 175°K for InSb, 240°K for InAs, 235°K for GaSb, and 247°K for GaAs. The neutron wavelength employed was 1.391 Å. (auth)

34608 ELASTIC SCATTERING OF SLOW ELECTRONS BY CESIUM ATOMS. Philip M. Stone and John R. Reitz (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 131: 2101-7(Sept. 1, 1963). (LADC-5473)

The elastic scattering cross section for the scattering of slow electrons by cesium atoms was calculated for incident electron energies ranging from 0.0005 to 0.13 Ry. The model used is an adiabatic one which includes exchange. By means of a partial-wave expansion the problem is reduced to the solution of an integrodifferential equation for each partial wave. The results of the calculation show rough agreement with low-energy plasma resistivity experiments and with collision-time measurements, but do not support the microwave experiments of Chen and Raether. The results of the calculation are quite sensitive to the inclusion of exchange and to the form of the polarization potential; arguments are presented to show that optimum parameters of an adiabatic model have been used in the present calculation. (auth)

34609 ELASTIC AND INELASTIC COLLISION CROSS SECTIONS IN HYDROGEN AND DEUTERIUM FROM TRANSPORT COEFFICIENTS. A. G. Engelhardt and A. V. Phelps (Westinghouse Research Labs., Pittsburgh). Phys. Rev., 131: 2115-28(Sept. 1, 1963).

By means of a numerical solution of the Boltzmann equation, elastic and inelastic collision cross sections were derived for electrons in H_2 and D_2 subjected to a d-c electric field. The cross sections for momentum transfer, rotational excitation, vibrational excitation, electronic excitation, and ionization are investigated by comparing experimental and theoretical values of transport coefficients. The same momentum transfer cross section previously obtained for H_2 by Frost and Phelps has been found to be valid for D_2. Good agreement is secured between experiment and theory by multiplying the theoretical rotational cross sections of Gerjuoy and Stein by approximately 1.5, provided the polarization factor of Dalgarno and Moffett is used. The final cross section for vibrational excitation of H_2 has a threshold at 0.52 ev and a peak of 7.7×10^{-17} cm^2 at 4.5 ev, whereas that of D_2 has a threshold at 0.36 ev and a peak of 6.6×10^{-17} cm^2 at 4.7 ev. The derived electronic excitation cross sections are the same for both H_2 and D_2. The ionization cross section was taken from the experimental results of Tate and Smith. Calculated transport coefficients for electrons subjected to crossed electric and magnetic fields, and high-frequency a-c electric fields are in agreement with recent experimental and theoretical results. (auth)

34610 THREE-BODY BOUND STATE IN He^4. J. M. Blatt (New York Univ., New York and Univ. of New South Wales, Kensington, Australia), J. N. Lyness, and Sigurd Yves Larsen. Phys. Rev., 131: 2131-2(Sept. 1, 1963).

The binding energy of three He^4 atoms, subject to pair forces, is investigated numerically for a number of proposed intermolecular potentials and for a series of square wells. For some potentials a 3-body bound state is found, for others not. However, a direct correlation is found between 2-body and 3-body binding. The need for more accurate experimental data is discussed. (auth)

34611 KINETIC APPROACH TO CONDENSATION. Richard L. Liboff (New York Univ., New York). Phys. Rev., 131: 2318-25(Sept. 1, 1963).

A kinetic formalism including a Boltzmann-like equation is introduced to study classical condensation phenomena in gases. Force laws which include a repulsive core together with an r^{-N} attractive tail are examined for all integral N greater than unity. The theory considers perturbations whose wavelengths are large compared to the diameter of the core. The results fall into two categories depending on whether $N \leq 3$ or $N \geq 4$, respectively, For the first class of long-range forces, there are no stable thermodynamic states. For the second class of short-range forces, phase-equilibrium curves are found which are in accord, qualitatively, with classical results. In the limit as $N \to \infty$, all states are stable. A discussion of the effects of random collisions is included. (auth)

34612 VARIATIONAL PRINCIPLES AND ENTROPY PRODUCTION. Eugene I. Blount (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 131: 2354-64(Sept. 1, 1963).

A variational principle has been found which is valid for irreversible processes, whether microscopic reversibility is obeyed or not, and beyond the region of linear response. A convenient general expression for entropy production is also found and the relation of entropy production to the solution of transport problems is discussed. (auth)

34613 INHIBITION OF THE SCINTILLATION OF He II. Frank E. Moss and Frank L. Hereford (Univ. of Virginia, Charlottesville). Phys. Rev. Letters, 11: 63-4(July 15, 1963).

The scintillation of liquid helium was observed from 5.3-Mev alpha particles traversing the fluid at various temperatures between 4.2 and 1.6°K. The intensity of light emitted per alpha particle was found to decrease significantly as the temperature dropped below the λ point. A clear quantitative interpretation is not given, but the phenomenon is attributed to the superfluidity of He II. (R.E.U.)

34614 JOSEPHSON CURRENTS IN SUPERCONDUCTING TUNNELING: THE EFFECT OF MICROWAVES AND OTHER OBSERVATIONS. Sidney Shapiro (Arthur D. Little, Inc., Cambridge, Mass.). Phys. Rev. Letters, 11: 80-2 (July 15, 1963).

Tunneling crossings of low resistance (5 to 20 Ω with a crossing area of 1.5×10^{-4} cm^2) were fabricated. Each of these exhibited zero-voltage currents predicted by Josephson and attributed, in effect, to the tunneling of Cooper

pairs. New effects are summarized from experiments on the $Al/Al_2O_3/Sn$ samples. (R.E.U.)

34615 QUANTIZED FLUX PENETRATION THROUGH THIN SUPERCONDUCTORS. J. E. Mercereau and L. T. Crane (Ford Scientific Lab., Dearborn, Mich.). Phys. Rev. Letters, 11: 107-8(Aug. 1, 1963).

The critical magnetic fields of thin, hollow, superconducting Sn cylinders are measured as a function of temperature from 1.2 to 3.7°K. On the basis of the theory of quantization of magnetic flux penetration in mechanically singly connected superconductors, the critical field (H_T) should equal $4\pi H_{cb}^2 \lambda^2/\phi_0$, where H_{cb} is the critical field in the bulk superconductor, λ is the effective penetration depth, and ϕ_0 is the magnetic flux quantum (= hc/2e). Measurements are made of H_T, H_{cb}, and λ by direct methods. The experimental values of H_T agree with those calculated on the basis of the experimental values of H_{cb} and λ. (T.F.H.)

34616 MECHANISMS FOR SUPERCONDUCTIVITY IN THE TRANSITION METALS. James W. Garland, Jr. (Univ. of Chicago). Phys. Rev. Letters, 11: 111-14(Aug. 1, 1963).

From experimental results on superconducting transition metals, regarding their reduced isotope effects on superconductivity, the pressure dependence of the transition temperature, the relation of the transition temperature to position in the periodic table, and impurity effects, it is shown that the Bardeen-Cooper-Schrieffer theory of superconductivity is valid for these metals. It is found that a one-gap dirty-superconductor theory explains the experimental results. (T.F.H.)

34617 ISOTOPE EFFECT IN SUPERCONDUCTIVITY. James W. Garland, Jr. (Univ. of Chicago). Phys. Rev. Letters, 11: 114-19(Aug. 1, 1963).

Calculations of the coefficient representing the isotope effect in superconductors are carried out and results tabulated. The calculated and experimental values for this coefficient compare favorably. It is found that differences between the isotopic effects in transition metals and "simple" metals can be explained in terms of band structure. (T.F.H.)

34618 MAGNETIC FIELD AND PHASE TRANSITION IN THIN FILM SUPERCONDUCTORS. Yoichiro Nambu (Univ. of Chicago) and San Fu Tuan. Phys. Rev. Letters, 11: 119-21(Aug. 1, 1963). (EFINS-63-43)

It is found, on the basis of calculations extended from the bulk-superconductor case, that for thin-film superconductors: the superconducting-normal phase transition induced by a magnetic field is second-order at all temperatures; a simple scaling rule exists concerning the field and temperature dependence of the energy gap; and the critical field depends on the thickness and temperature according to a certain formula for thicknesses above about 0.5×10^{-5} cm. (T.F.H.)

34619 SUPERCURRENT DISSIPATION. G. M. Foster (Pomona Coll., Claremont, Calif.). Phys. Rev. Letters, 11: 122-4(Aug. 1, 1963).

An alternating axial magnetic field is applied to a superconducting In hollow cylinder, with a frequency of 23 cps to 25 kc. The magnetic field attenuation inside the cylinder is measured down through the transition temperature, and the results suggest than an ohmic dissipation of the supercurrent is brought about by the presence of the field. The field amplitudes are chosen small enough that the field wave-form inside the cylinder is undistorted, and that the field attenuation is practically independent of the field amplitude. (T.F.H.)

34620 XENON IMPURITY STATES IN SOLID ARGON. G. Baldini and R. S. Knox (Univ. of Rochester, N. Y.). Phys. Rev. Letters, 11: 127-9(Aug. 1, 1963).

Solid Air films containing 0.1 to 1 mole % Xe are prepared from 8 to 10°K. The absorption spectra are measured at 1050 to 1500 Å, and the results are interpreted in terms of "trapped excitons." Using a one-electron model, the effective mass of the conduction electrons is determined experimentally to be 0.46 electron masses. (T.F.H.)

34621 NONLINEAR SPACE-CHARGE WAVES WITH TRAPPED ELECTRONS. H. S. C. Wang (Univ. of Colorado, Boulder). Phys. Rev. Letters, 11: 141-3(Aug. 15, 1963).

It is shown that large-amplitude space-charge waves in electron streams with electrons of one stream trapped in the wave troughs can also propagate along another stream. The streams are assumed to have infinite and uniform cross sections, while ion motion, collisions, and relativistic effects are neglected. The two-stream case is considered but the method can be applied to other multistream problems. (C.E.S.)

34622 INFLUENCE OF TRANSPORT CURRENT ON THE MAGNETIZATION OF A HARD SUPERCONDUCTOR. M. A. R. LeBlanc (Stanford Univ., Calif.). Phys. Rev. Letters, 11: 149-52(Aug. 15, 1963).

The influence of transport current on the magnetization of cold-worked Nb–Zr wire in a transverse field was studied at 4.2°K. The magnetic moment is reduced by the transport current and tends to zero as the critical current is approached. At any given field the curve of magnetic moment vs transport current is not single-valued, but is seen to depend on the sequence of application of the current and field and also on the history of the transport current at the final field. (C.E.S.)

34623 ANOMALOUS DENSITY OF STATES IN THICK SUPERCONDUCTING LEAD FILMS. P. Townsend and J. Sutton (Plessey Co., Ltd., Towcester, Northamptonshire, Eng.). Phys. Rev. Letters, 11: 154-6(Aug. 15, 1963).

Aluminum is used as the reference superconductor in a detailed study of the fine structure in the current vs voltage characteristics of superconductor-barrier-lead tunneling junctions. The fine structure shows a marked dependence on the thickness of the lead film and it is concluded that this anomalous behavior can best be explained in terms of an effective density of states. The effective density of states is thought to arise from two parts of the Fermi surface contributing different energy gaps and having different normal densities of states associated with them. The characteristics, measured as a function of temperature and lead film thickness, are presented. (C.E.S.)

34624 PAIR CORRELATIONS IN SUPERCONDUCTING TANTALUM. L. Meyers and W. A. Little (Stanford Univ., Calif.). Phys. Rev. Letters, 11: 156-7(Aug. 15, 1963).

Superconducting tantalum was investigated to determine the periodicity of the transition temperature. The transition to the superconducting state was broad, beginning at 4.1°K and being complete at ~1.5°K. Over a small region of temperature between 2.4 and 2.2°K the characteristic periodic variations of the resistance due to the variation in the transition temperature could be seen as the magnetic field was varied sinusoidally. Excellent agreement between the observed period and hc/2e is obtained, showing through the factor 2e that the electrons are indeed correlated in pairs in superconducting tantalum. (C.E.S.)

34625 CLASSIFICATION OF RESONANCES IN THE ELECTRON SCATTERING CROSS SECTION OF Ne AND He. J. Arol Simpson and U. Fano (National Bureau of

Standards, Washington, D. C.). Phys. Rev. Letters, 11: 158-9(Aug. 15, 1963).

Resonances in the differential cross section for electron scattering at 72° by He and Ne were investigated. Measurements were made of the electron-beam current transmitted through He or Ne as a function of the incident electron energy. In He the resonance at 19.3 ev appears as a sharp increase in transmission. The transmission in Ne shows a doublet structure consisting of two sharp decreases in transmission. The resonance in He is at 16.0 ± 0.1 ev. (C.E.S.)

34626 NEW KINETIC EQUATION. Guido Sandri (Aeronautical Research Associates of Princeton, Inc., N. J.). Phys. Rev. Letters, 11: 178-9(Aug. 15, 1963).

A kinetic equation for the single-particle distribution function for particle behavior in a gas is derived. The proper description of both the close encounters and of the dielectric screening is included in this equation. (C.E.S.)

34627 SUMMARY OF LCAO COMPUTATIONS OF ENERGY AND ELECTRONIC STRUCTURES OF THE MOLECULE Li_2 IN THE GROUND STATE AND IN SOME EXCITED STATES. C. Manneback (Université, Louvain, Belg.). Physica, 29: 769-83(July 1963). (In English)

An investigation of the lowest electronic states of the lithium molecule was made by the linear combinations of atomic orbitals (LCAO) and molecular orbitals (MO) method to determine the relative importance of the proper choice of Slater's orbital exponents and of a full configuration interaction. The six electrons were considered in the orthogonal Slater determinantal wave functions of each configuration and the interaction computed. (C.E.S.)

34628 SECONDARY ELECTRON RESONANCE DISCHARGE. I. STEADY STATE BY DEBUNCHING. D. K. Callebaut (Interuniversitair Instituut voor Kernwetenschappen, Ghent). Physica, 29: 784-802(July 1963). (In English)

It is shown that the space charge effects play a prominent part in the secondary electron resonance discharge. General considerations on the steady state are given and an approximative condition is derived that determines a selected initial velocity as a function of the secondary emission coefficient and velocity distribution. A survey is given of the possible causes that limit the current and the steady state as determined by debunching losses due to the repulsion between the electrons is studied and the corresponding current is calculated. All equations are put in a general and elegant form by introducing dimensionless quantities: those related to the field and initial velocity introduced by Krebs and Meerbach and a new one related in a similar manner to the charge. When the charge tends to zero the limits of the multipactordomain as determined by the elementary theory are found. If the parameters involved in the problem are varied, an estimate of the maximum value of the charge is obtained without calculation by comparison of the dimensionless quantities. (auth)

34629 THERMAL CONDUCTIVITY OF SUPERCONDUCTORS. K. D. Chaudhuri (Univ. of Delhi). Physica, 29: 816-18(July 1963). (In English)

An attempt is made to explain the thermal conducting decrease in the superconducting phase when the transition temperature is in the lattice scattering region, i.e., if the dominant scatterers are lattice vibrations. Superconducting attenuation arising in the irreversible flow of energy from the acoustical phonons to the thermal phonons is considered. (C.E.S.)

34630 NONEQUILIBRIUM IONIZATION IN MHD GENERATORS. R. J. Rosa. Proc. IEEE (Inst. Elec. Electron. Engrs.), 774-84(May 1963).

A brief review is given of the basic principles of MHD power generation and its current status. The problem of obtaining the level of gas ionization required for MHD generation is also discussed. (TCO)

34631 A CLASS OF SOLUTIONS REPRESENTING PLANE ELECTROMAGNETIC WAVES IN GENERAL RELATIVITY. Markandeya Misra (Banaras Hindu Univ., Varanasi, India). Proc. Natl. Inst. Sci. India. Pt. A, 29: 104-13(Jan. 26, 1963). (In English)

The Einstein-Maxwell field equations in vacuo were reduced to a system of equations one of which is the 2-dimensional wave equation in curved space-time. When certain simplifying assumptions are made a class of exact solutions representing plane electromagnetic waves in vacuo is obtained. (auth)

34632 THERMAL SCATTERING OF ATOMS BY HOMONUCLEAR DIATOMIC MOLECULES. R. B. Bernstein (University Coll., London), A. Dalgarno, Harrie Massey, and I. C. Percival. Proc. Roy. Soc. (London), Ser. A, 274: 427-42(Aug. 13, 1963).

The formal theory of scattering by a rigid rotator is applied to the problem of the rotational excitation and elastic scattering of homonuclear diatomic molecules by atoms. A statistical theory is employed to analyze the effects of the strong coupling that occurs between the different scattering channels. Numerical results are presented for the collision of argon and nitrogen at room temperature. (auth)

34633 A MEASUREMENT OF THE IONIZATION CROSS-SECTION OF Ne^+ TO Ne^{2+} BY ELECTRON IMPACT. K. T. Dolder, M. F. A. Harrison, and P. C. Thonemann (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Roy. Soc. (London), Ser. A, 274: 546-51(Aug. 13, 1963).

A crossed-beam method was used to measure the cross-section of Ne^+ in the reaction $Ne^+ + e \rightarrow Ne^{2+} + 2e$. The cross-section increases linearly with electron energy near the threshold and attains a maximum value of 3.13×10^{-17} cm^2 at 200 ev. The errors in the measurements were estimated to be less than ±10%, and the highest incident electron energy used was 1000 ev. A semi-empirical formula proposed by Drawin in 1961 describes the measured cross-section within the above limits of error when the two adjustable parameters take the values $\xi f_1 = 5.25$ and $f_2 = 0.70$. (auth)

34634 DIFFUSION CONSTANTS OF ^3He IN LIQUID HELIUM II. Emiko Fukuda and Ryogo Kubo (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 29: 621-50(May 1963). (In English)

The diffusion constant D_s of He^3 atoms in liquid helium II was measured by Garwin and Reich using spin echoes. It is now pointed out that D_s may in general differ from D if the solute-solute interaction becomes appreciable. The expressions of D_s and D are given and discussed from a general point of view. Then the expressions are simplified into approximation formulas that correspond to simplest solutions of the Boltzmann equations. The temperature and concentration dependence of D_s and D at low temperatures and low concentrations is discussed on fairly general assumptions. The existent data of D and D_s are reviewed on this basis. The difference of D and D_s seems to be significant. (auth)

34635 GREEN'S FUNCTION THEORY OF MAGNETIC RELAXATION. II. A FERROMAGNET ABOVE THE

CURIE TEMPERATURE. Motoyuki Tanaka and Kazuhisa Tomita (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 29: 651-74(May 1963). (In English)

As an application of the general theory, line width in the paramagnetic range of temperature is discussed in terms of the spatial correlations of spin deviations. It is shown that the width decreases monotonically with decreasing temperature and that it decreases more rapidly with decreasing temperature than that predicted by previous theories based on the second moment. This is considered as a consequence of the fact that the net effect of modulation due to the exchange interaction will be enhanced in the neighborhood of the critical point. The effect of including the non-secular interaction is also examined. It is shown that the temperature dependence of width is not affected very much by them; however, its magnitude becomes 10/3 times that of the secular width in the limit of high temperature, which is consistent with the results obtained by other theories. (auth)

34636 NON-LOCAL CORRELATION EFFECT ON PERIODIC FIELD, ANTISCREENING. Minoru Tanaka (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 29: 675-90(May 1963). (In English)

The role of electron-electron correlation effects in determining the energy spectrum near the first energy gap in alkali metals is investigated by the use of the propagator formalism. The correction of potential due to its screening effect is unimportant and negligible. The vertex correction that corresponds to the charge renormalization in field theory has an important role of antiscreening and makes the energy gap larger. The evaluation of the vertex correction is made to the first order diagrams of the effective Coulomb interaction. The enhancement of the energy gap at the center of the zone boundary due to the vertex correction amounts to an order of ten percent of the calculated energy gap in the OPW method in the case of lithium metal. The Fermi surface of the valence electron in lithium is pulled nearer to the zone boundary in the direction (110) and the distortion due to the vertex correction amounts to a few percent of the Fermi momentum. It is essential for the problem of zone-contact in lithium metal to take into account the vertex correction in the calculation of the energy band. (auth)

34637 ON THE BEHAVIOR OF THERMAL CONDUCTIVITY NEAR THE MAGNETIC TRANSITION POINT. Kyozi Kawasaki (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto), 29: 801-16(June 1963).

The anomaly of thermal conductivity at the magnetic transition point observed in certain magnetic crystals was treated theoretically using the correlation function expression for the thermal conductivity. The heat conduction by the spin system is shown to be negligible in the vicinity of the transition point. The phonon thermal conductivity was studied when the transition temperature is much smaller than the Debye temperature adopting a simple spin-phonon coupling derived by a consideration of the change of energy of the spin system caused by the strain due to a phonon. Processes involving creation and annihilation of a phonon as well as scattering were considered, and the anomalous temperature dependence of thermal conductivity at the transition point was understood in terms of the critical scattering of phonons by critical fluctuations of the energy density of the spin system that is revealed in the specific heat of the spins. Cases with more general types of the spin-phonon interaction are briefly discussed. (auth)

34638 PROPAGATION OF SPACE CHARGE DENSITY WAVES AND ELECTRON GROUPING IN ROTATING ELECTRON FLUXES WITH CENTRIFUGAL-ELECTROSTATIC FOCUSING. Z. S. Chernov and G. A. Bernashevskii. Radiotekhn. i Elektron., 8: 973-84(June 1963). (In Russian)

Propagation of high-frequency oscillations in the direction of a centrifugal-electrostatic focused electron flux was studied in linear and nonlinear approximations. It is shown that under the examined conditions the space-charge wave density increases. The nonlinear processes in centrifugal-electrostatic focused electron resonator were examined by a field method. Experiments confirmed the presence of increasing waves. (tr-auth)

34639 ABSOLUTE SPACE-TIME FORM OF MAGNETOHYDRODYNAMIC EQUATIONS. Cataldo Agostinelli. Rev. Univ. Nacl. Tucuman, Ser. A, 14: 127-52(1962). (In Spanish)

The space-time equations of the motion of a perfectly conducting fluid exposed to self-gravity, in which is evident electromagnetic actions, are established in homographic vectorial absolute form. Two vector (axial) homographs are introduced that operate on vectors tangent to a quadridimensional space-time metric variety, V_4, which represent the electric field, the magnetic induction, the electric induction, and the magnetic field. From these equations, the Maxwell and Euler equation of ordinary magnetofluidynamics are deduced in the first approximation. (tr-auth)

34640 OPTICAL PUMPING. Thomas R. Carver (Princeton Univ., N. J.). Science, 141: 599-608(Aug. 16, 1963).

Optical pumping refers to the redistribution of atoms among their fine- and hyperfine-structure levels by means of light. The resonance radiation of the atom is usually the radiation used. This is selected in some way, specifically by being circularly polarized, anisotropic, filtered, or amplitude-modulated. By simple experimental techniques it is possible to measure the fine and hyperfine structure of atoms, the magnetic moments of radioactive nuclei, the cross sections of a number of interesting processes, and the magnetic properties of free ions and electrons, and to produce useful polarization of atoms, nuclei, and electrons. The techniques have led to the development of atomic clocks and magnetometers useful in measuring the weak magnetic fields of the earth and in space. The techniques have also been partly responsible for the development of the laser. The process of optical pumping, methods of observation, and possible applications are discussed. Application in a study of the details of the fine structure of the resonance radiation states for Na are included. (C.H.)

34641 EXCITATION IN RADIO-FREQUENCY DISCHARGES. R. Mavrodineanu and R. C. Hughes (North American Philips Co., Inc., Irvington-on-Hudson, N. Y.). Spectrochim. Acta, 19: 1309-17(Aug. 1963). (In English)

The possibility of using a radio-frequency, flame-like discharge as an excitation source for spectroscopy was investigated. Both a triode driven oscillator of 250 watt output at 30 Mc, and a magnetron powered unit of 2 kwatt output at 2450 Mc were employed. The rf-excited spectra, between 2000 and 10,000 Å, of air, N_2, O_2, He and H_2 were examined. Helium and H_2, producing simple spectra, provide advantageous discharge sustaining atmospheres for excitation of line and band spectra of many chemical species. Techniques are described for the introduction of solid and liquid samples into the discharge. Spectra of some seventy-five elements were excited and their emissions are discussed. The application of RF excitation to quantitative

analysis is illustrated by the analysis of tin–lead solders, within the range of 30–55% tin, for major constituents. The rf discharge at atmospheric pressure in He or H_2 appears to be a valuable technique, widely applicable for spectroscopic investigations. (auth)

34642 ELECTRON PRESSURE AND LINE INTENSITY RATIO AS A FUNCTION OF THE TEMPERATURE OF AN ELECTRIC ARC. C. Gerthelot (Euratom, Geel, Belg.). Spectrochim. Acta, 19: 1323-34(Aug. 1963). (In French)

The line intensity ratio (λMII/λMI) for Be, Mg, Ca, Ti, V, Cr, Mn, Mo, and Eu changes with the d-c arc temperature (C, CuO, Li_2CO_3 and KCl matrices). The relation between the electron pressure and the temperature is $\log P_e\,(atm) = -(27{,}255)/(T) + (5)/(2)\log T - 8.50$ and the number of electrons present in the plasma is $N_e(cm^{-3}) = 2.32 \times 10^{13} T^{3/2} \exp -5.40\ (ev)/kT$. Temperature and electron pressure in the plasmas and in the different layers of the sun can be determined by this method. (auth)

34643 MOTION OF ELECTRICALLY CHARGED PARTICLES IN CIRCULARLY POLARIZED ELECTROMAGNETIC FIELDS AND IN CROSSED LINEARLY POLARIZED FIELDS WITH TRANSIENT RANDOM FIELDS. Winfried Otto Schumann (Technische Hochschule, Munich). Z. Angew. Phys., 15: 547-9(June 1963). (In German)

In circularly polarized fields, particle accelerations occur only when E and H are not spatially perpendicular to each other, but when a component of H following or preceding in the rotation direction by 90° is present. In linearly polarized spatially crossed fields of any time pattern it was shown that with proportionality of both fields no acceleration occurs. The field patterns that produce specified motions are discussed. (tr-auth)

34644 GAS SEPARATION WITH MOLECULAR PUMPS. II. SEPARATION FACTOR AND SEPARATION POTENTIAL OF A MOLECULAR PUMP WITH POSITION-INDEPENDENT SLIT HEIGHT. Otto Boettger and Hans Pingel (AEG Forschungsinstitut, Frankfurt am Main). Z. Angew. Phys., 15: 556-61(June 1963). (In German)

The separation factor and separation potential of a molecular pump with position-independent slit height was calculated for a two-component gas mixture, in which one of the components is present only in small concentrations. Knudsen streaming was assumed. Numerical values for the separation factor and separation potential were given for uranium hexafluoride. (tr-auth)

34645 ON THE PROPAGATION OF ALFVÉN WAVES IN CERTAIN ROTATIONAL SYMMETRIC MAGNETIC FIELDS. F. Winterberg (Case Inst. of Tech., Cleveland). Z. Naturforsch., 18a: 701-5(June 1963). (In English)

The general results of previous work were applied to the propagation of Alfvén waves in certain rotational symmetric magnetic fields. It is shown that for finite field strength no bound states of such waves exist. The transmission and reflection coefficients were calculated for a certain class of simple fields. In some special cases the problem could be solved rigorously, in other cases it was convenient to apply Born approximation. (auth)

34646 MASS SPECTROMETRIC OBSERVATION OF ELECTRON AND PROTON TRANSFER REACTIONS BETWEEN POSITIVE IONS AND NEUTRAL MOLECULES. PART II. A. Henglein and G. A. Muccini (Mellon Inst., Pittsburgh and Hahn-Meitner-Institut für Kernforschung, Berlin). Z. Naturforsch., 18a: 753-61(June 1963). (RRL-110). (In English)

The method of Cermak and Herman was applied to studies of unsymmetrical charge and proton transfer reactions. If the charge is transferred between atoms, low cross sections are observed since part of the kinetic energy of the reacting system has to be converted into internal energy of the reactants. Large cross sections, however, were found for the charge transfer between polyatomic species where apparently no resonance restriction exists. In several instances the unsymmetrical transfer $B^+ + A \rightarrow B + A^+$ has a higher rate than either of the processes $B^+ + B$ or $A^+ + A$. If the ionization potential of B is lower than that of A the cross sections are in general low. In certain cases exceptionally large cross sections are observed and can be explained by the excess energy of a long lived excited state of the donor B^+. Dissociations following the transfer of one charge from a doubly charged ion to a neutral molecule such as $Kr^{2+} + H_2O \rightarrow (Kr^+)^* + (H_2O^+)^* \rightarrow OH^+ + H$ and $NO^{2+} + NO \rightarrow (NO^+)^* + (NO^+)^* \rightarrow N^+ + O$ were also observed. The results indicated that the doubly charged ion generally captures the electron into a high lying orbital. Protonated cyclopropane is shown to be readily formed in ionized cyclopropane. In mixtures of water and methane, proton transfer was observed in both directions. A large isotope effect on the secondary ion currents resulting from the transfer of a deuteron or a proton was found in several simple systems. This isotope effect appeared only if the secondary ions were observed in the Cermak–Herman method and was not found in the conventional operating of the ion source where reactions of slow ions predominate. This information provided some insite into the mechanistic details of the proton transfer since little isotope effect was expected if the reaction occurred via an inelastic collision complex while an isotope effect of the order of magnitude observed was predicted by a stripping model. (auth)

34647 CRITICAL CURRENT INTENSITY OF SUPERCONDUCTING Nb_3Sn DIFFUSION LAYERS IN STATIONARY MAGNETIC FIELDS UP TO 90kOe. L. Rinderer (Université, Lausanne, Switzerland) and E. Saur. Z. Naturforsch., 18a: 771(June 1963). (In German)

The curves of critical current intensity in transversal magnetic field up to 90kOe at 4.2°K were measured for layers of Nb_3Sn with the help of a Bitter solenoid. The effects of the temperature of heat treatment of the metal layers were determined. (M.C.G.)

34648 OPTICAL INVESTIGATIONS OF THE SHARP ABSORPTION LINES IN RADIATION-COLORED LiF. Wolf von der Osten (Technische Hochschule, Munich). Z. Physik, 174: 423-33(1963). (In German)

The thermal and optical behavior of radiation-colored LiF was distinguished by two types of lines: equi-distant line groups and single lines. The equi-distant lines of the groups could be synthesized and decomposed by annealing or optical bleaching. They are attributed to the same color centers as those which support interference bands. The single lines appear in colored crystals after annealing or irradiation with light by rearrangement or assemblage of several color centers to a large color-center association. They are very stable toward optical bleaching. (tr-auth)

34649 ENERGY DISTRIBUTIONS OF FAST LITHIUM AND SODIUM IONS IN INTERACTIONS WITH RARE GASES. H. Boersch, G. Forst, and S. Schweda (Technische Universität, Berlin). Z. Physik, 174: 446-59(1963). (In German)

Li^+ and Na^+ ions (30 kev) interacting with rare gases showed energy distributions with discrete and continuous energy losses. The smallest discrete energy losses can be explained by excitation of the rare gas atom shell nearest to the ground state. Higher energy losses can be explained by neutralization (charge exchange) and reneutralization

connected with excitation of the neutral alkali atom; this explanation is supported by spectroscopic measurements. Other discrete energy losses can be described, not always uniquely, by several other excitation, neutralization, and ionization processes. (auth)

34650 THE REFLECTION OF MODULATED HELIUM AND DEUTERIUM MOLECULAR BEAMS FROM PLATINUM SURFACES. Sheldon Datz, George E. Moore, and Ellison H. Taylor (Oak Ridge National Lab., Tenn.). p.347-61 of "3rd International Rarefied Gas Dynamics Symposium. Vol. I." New York Academic Press, 1963.

A modulated molecular beam with phase sensitive detection was used to study the scattering of D_2 and He from polycrystalline platinum. This technique enhances sensitivity and allows comparison of molecular transit times, which can reveal surface residence of energy interchange. For surface temperatures above about 400°, the angular distributions are specular. Nevertheless, the detailed dependence of the distribution upon beam temperature and angle of incidence, and the differences between D_2 and He suggest some energy exchange without prior condensation. At lower surface temperature, the scattering is diffuse, apparently because of surface contamination. (auth)

34651 A REVIEW OF THE THEORY OF CHARGE TRANSFER IN GASES. Donald Rapp (Lockheed Missiles and Space Co., Palo Alto, Calif.). 14p. (CONF-74-20)

From 11th Annual Conference on Mass Spectrometry and Allied Topics, San Francisco, May 1963.

The theory of single-charge-exchange reactions between fast ions and (like or unlike) atoms in a thermalized gas is outlined. Ion velocities of 10^5 to 10^8 cm/sec are given almost exclusive attention. (T.F.H.)

34652 CHARGED AEROSOL ENERGY CONVERTER. A. Marks (Marks Polarized Corp., Whitestone, N. Y.), E. Barreto, and C. K. Chu. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-158, 13p, $1.00. (CONF-97-10)

From Summer Meeting, Los Angeles, June 1963.

The charged aerosol energy converter is an electrohydrodynamic unit which operates more efficiently than other electrohydrodynamic devices. By using charged aerosol particles in a dense gas the mobility is reduced so that slip velocities become negligible. A theoretical model is discussed and the solution of the equations indicates that constant gas velocity or constant thermodynamic state operation is possible. The experimental results show excellent agreement with the theoretical model hence verifying the assumptions made. It is demonstrated both experimentally and theoretically that the only limitation to the generator is electric breakdown. At present the operation is confined to high velocity due to difficulties in producing the aerosol. (auth)

34653 A SHOCK TUBE STUDY OF THE ELECTRIC POLARIZABILITY OF ATOMIC HYDROGEN. Wayland Clinton Marlow, III and Daniel Bershader (Lockheed Missiles and Space Co., Sunnyvale, Calif.). 80p. (CONF-46-62)

From American Physical Society Meeting, Washington, D. C., Apr. 1963.

A study of the electric polarization properties of gaseous hydrogen under various thermodynamic conditions, including an experimental investigation of a shock-heated flow containing an appreciable amount of atomic hydrogen was presented. The mean or average polarizability was calculated for various possible thermodynamic states of a high temperature hydrogen gas. The thermodynamic conditions considered in the theoretical investigation include dissociation, excitation, and ionization phenomena. Both the static and dynamic or frequency-dependent polarization problems are treated. The theoretical work is supplemented by an experimental investigation in which a measurement is performed by application of Mach-Zehnder interferometry to a shock-heated hydrogen-argon gaseous mixture. The resulting experimental value of the dynamic polarizability of atomic hydrogen is in excellent agreement with the theoretical value. (auth)

34654 GENERALIZED THEORETICAL STUDY OF VAPOR FILLED THERMIONIC CONVERTERS. John Psarouthakis (Martin Marietta Corp., Baltimore). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-157, 18p, $1.00. (CONF-97-22)

From Summer Meeting, Los Angeles, June 1963.

A generalized theoretical model is proposed and used to derive a number of analytical expressions that predict the performance characteristics of vapor filled thermionic converters over a wide range of conditions. The analysis is made with primary consideration to: the coexistence of negative and positive sheaths at the emitter surface; influence of surface and collision ionizations; spacing of the converter; the variation of the electron temperature; the variation of the potential at which the ionization by collision becomes significant; patchy surfaces; and the energy balance. Comparison of the results of this theory is made with available experimental data on molybdenum and rhenium, which indicate an excellent agreement. (auth)

34655 THE INVESTIGATION OF POTENTIAL LASER CRYSTALS CONTAINING RARE EARTH DOPANTS. J. J. Sjoblom (TRG, Inc., Syosset, N. Y.). 10p. (CONF-20-10)

From 3rd Rare Earth Conference, Clearwater, Fla., Apr. 1963.

The crystal growth and preparation aspects of the rare earth laser program are reviewed. The purpose of this program is to develop solid state media for lasers based on light absorption and emission by rare earth ions incorporated in the solid state media. First a number of rare earth chelates in solution or crystallized from solution were examined. The second system examined was anhydrous lanthanum chloride as the host crystal for anhydrous rare earth chlorides. The third system was based on the scheelite (calcium tungstate) type of crystal as the host. Various other systems were explored. The scheelite type of crystal doped with neodymium was proved to laser at 1.065 microns. The role of crystal quality in both CW and pulsed laser performance is analyzed briefly. (auth)

34656 GRID CONTROLLED PLASMA ELECTRON BEAM. M. A. Cocca and L. H. Stauffer (General Electric Co., Schenectady, N. Y.). 26p. (CONF-57-6)

From 5th Electron Beam Symposium, Boston, Mar. 1963.

An experimental development for producing controlled electron beams of high intensity in low pressure gases is described. A hollow cylindrical cathode with perforated walls is provided with a concentric internal grid and a beam-forming aperture at one end of the cathode. The unheated cathode emits a collimated electron beam ranging in energy from 3 to 20 kilovolts depending on the adjustment of gas pressure and cathode potential. Electron beam currents of 2 amperes or more are readily produced at beam power levels of over 30 kilowatts. Continuous adjustment of the beam intensity, without affecting its focus, is accomplished by applying a small bias voltage between a control grid and the cathode. Since the grid controls the flow of low-energy electrons from the internal walls of the cathode, beam response is fast and continuous. Because

the cathode is rugged and simple and operates unheated in a gas at low pressure, it has important advantages for electron-beam thermal processing applications. As a process tool it provides the inherent advantages of hot-cathode electron-beam devices without the limitations imposed by the sophisticated gun and auxiliary equipment designs required in hot cathode equipment. Experiments demonstrate the ability of the plasma electron beam to perform melting and refining operations in a controlled atmosphere. These experiments give an indication of the degree to which the device can be employed in melting, welding, sintering, and heat treating processes. Other possible applications include beam power tube amplifiers and oscillators, microwave power generation by plasma interaction, and electron beam irradiation of materials. (auth)

34657 SCATTERING OF SPIN WAVES BY MAGNETIC DEFECTS. Joseph Callaway (Univ. of California, Riverside). 35p. (CONF-30-4)

From American Physical Society 1962 Winter Meeting in the West, Stanford, Calif., Dec. 1962.

The scattering of spin waves by magnetic point defects is considered using a Green's function method. A partial wave expansion for the scattering amplitude is derived. An expression for the cross section is determined that includes the effect of resonant states. Application is made to the calculation of the thermal conductivity of an insulating ferromagnet. (auth)

34658 LOW ENERGY X-RAY MASS ABSORPTION COEFFICIENTS. R. W. Carter, R. H. Rohrer, and G. R. Dyer (Emory Univ., Atlanta). 14p. (CONF-67-28)

From Health Physics Society 8th Annual Meeting, New York, June 1963.

The experimental determination of mass absorption coefficients as a function of energy (primarily below 6 kev) is studied. The actual measurements are from 17 to 1.49 kev in energy. The data from the k-edge down to 1.49 kev provide enough information to compare with semi-empirical calculations in this region. Absorbers are prepared by vacuum thermal evaporation, and thickness is determined by three methods-interferometry, fluorescent yield, and weight. The experiments are performed with a vacuum-tunnel spectrometer. The source of x rays is the continuum from a Siemens chromium target spectroscopy tube of Kα x rays excited from selected targets with energy selection accomplished by a standard Bragg spectrometer arrangement. Results for copper are emphasized. The experimental error is about 1.5%. The results agree with calculated values. (auth)

34659 FURTHER STUDIES OF COLLISION CROSS SECTIONS BY ION CYCLOTRON RESONANCE. D. Wobschall and J. Graham, Jr. (Cornell Aeronautical Lab., Inc., Buffalo). 10p. (CONF-78-8)

From American Physical Society 1963 Summer Meeting, Buffalo, June 1963.

Ion-molecule collision cross sections for He^+ on He, and H_2^+ and H_3^+ on H_2, are determined by analyses of ion cyclotron resonance lines. Low-energy ions are used. (T.F.H.)

Astrophysics, Cosmology, and Geophysics

34660 (AFCRL-62-753) THE STUDY OF A METHOD TO REDUCE ELECTRON DENSITY IN THE IONOSPHERIC D-REGION BY MEANS OF HIGH-POWERED GROUND-BASED TRANSMITTERS. Final Report. Paul Molmud, Saul Altshuler, and John H. Gardner (Space Technology Labs., Inc., Redondo Beach, Calif.). Sept. 1962. Contract AF19(604)-8844. 207p. (AD-287186)

A method of decreasing the electron density in the D-region is studied. The method involves the heating of electrons by intense electromagnetic radiation. This increases the electron attachment rate and thereby decreases the electron density. The relevant D-layer rate processes are reviewed and incorporated into a detailed analysis of the influence of a perturbing electromagnetic pulse upon the variation, in time of the electron density. The theory of conductivity of a weakly ionized gas is reviewed and augmented to include dependency on field strength. Propagation constants are determined, and the equations describing the nonlinear radial propagation of a powerful wave in a weakly ionized inhomogeneous medium are derived. Numerical solutions of these equations are obtained which describe the effects due to the vertical propagation of waves for several power levels and frequencies through a heavily perturbed D-region. It is found that the powerful wave modifies the electron density distribution. 63 references. (auth)

34661 (JINR-P-1326) YADERNYE VZAIMODEISTVIYA NA RANNEI STADII EVOLUTSII VSELENNOI. (Nuclear Interactions on the Early Stage of Evolution of the Universe). V. B. Belyaev and B. N. Zakhar'ev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 5p.

Zeldovich theory about the early stage of expanding universe is considered. It is essential for this theory that the value of entropy, which is accumulated up to the moment of formation of states, was less than a certain critical entropy. The effect of interactions of nucleons at densities of order of nuclear ones on the growth of entropy is studied. These interactions lead to the acceleration of nuclear reactions, bringing the system nearer to equilibrium state and reducing the growth of entropy. The conclusion made by Zeldovich and Yakubow, on the basis of the model of ideal gases, that entropy to the moment of stars formation does not exceed the critical value is confirmed. (auth)

34662 COSMOLOGY, MACH'S PRINCIPLE AND RELATIVITY. R. H. Dicke (Princeton Univ., N. J.). Am. J. Phys., 31: 500-9(July 1963).

The significance of Mach's principle for field theory is discussed, also the significance of zero-mass boson fields for the geometry of the physical space. The significance of such fields for Mach's principle within the framework of cosmology is also discussed. It is suggested that the distant matter of the universe generates one or two zero-mass boson fields, very likely a tensor field and perhaps a scalar, and that each of these fields propagates, carrying into the laboratory a quasistatic influence having its origin primarily in the distant matter of the universe. The observable effects of these Machian fields are described. (auth)

34663 THE ATOMIC SPECTRA OF THE RARE EARTHS: THEIR PRESENCE IN THE SUN. Charlotte E. Moore (National Bureau of Standards, Washington, D. C.). Appl. Opt., 2: 665-74(July 1963).

A summary of the present state of analysis of the first and second spectra of the rare-earth elements is presented with an extensive bibliography. The astrophysical importance of these spectra is stressed. Counts are given of the number of lines of each rare-earth spectrum identified at present in the accessible solar spectrum. Most of them appear only in the singly ionized state; exceptions are Eu,

Tm_I, and Yb_I. The possible presence of the strongest line of Ce_{III} in the solar spectrum is suggested. If correct, this is the first evidence of a third spectrum line in the accessible range of the solar spectrum ($\lambda > 3000$ Å). (auth)

34664 THE POSSIBILITY OF DETECTING AND INVESTIGATING DISTANT RADIATION BELTS BY RADIO-ASTRONOMY. A. A. Korchak (Inst. of Terrestrial Magnetism, Ionosphere and Radio-wave Propagation, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 150: 499-502 (May 21, 1963). (In Russian)

The synchrotron or cyclotron radiation due to the slowdown of electrons in a regular magnetic field has a frequency spectrum and a polarization which can be distinguished from cyclotron radiation originating from regions with a chaotic magnetic field. The characteristics of the cyclotron radiation (the Stokes parameters) can be calculated for fields of different configuration, and it is possible to obtain vital data on the magnetic field of the belt, and on the spatial, energy and angular distribution of electrons in the belt by comparison with the observed characteristics of the radiation. A dipole magnetic field with a magnetic moment M is assumed with the following electron distribution function: $N(E,r_e,\theta,a) = KE^{-\gamma} \exp[(q^2)/(a^2)(r_e - r_0)^2] k(n)h^{-n/2} \sin^n\alpha$. Here, $h = (1 + 3\cos^2\theta)^{1/2} \sin^6\theta$, and K, γ, q, r_0, and k are constants. Expressions are derived for the Stokes parameters for the total cyclotron radiation from a radiation belt. A term θ_m characterizes the latitudinal extent of the radiation belt. The constants k, n, γ, q, and r_0 as well as the magnetic moment M and the term θ_m can be determined by making measurements on the Stokes parameters involved. (TTT)

34665 MAN-MADE RADIATION BELTS. Wilmot N. Hess. Intern. Sci. Tech., No. 21, 40-8(Sept. 1963).

Immediate and long-range effects of the U. S. and Soviet high-altitude nuclear explosions are considered. The electron and proton flux and trajectories in the artificial radiation belt are discussed. The effects of the trapped particles on solar cells and as a radiation barrier to man are described. Problems in assessing the likely longevity of the artificial radiation belt are also discussed. (C.E.S.)

34666 LONGITUDINAL DISTRIBUTION OF SSC RISE TIMES. Tadanori Ondoh (Kyoto Univ.). J. Geomagnet. Geoelec., 14: 198-207(1963). (In English)

A longitudinal distribution of ssc rise time at middle and low latitudes was obtained by using rapid-run magnetograms at Koror, Honolulu, Tucson, and Fredericksburg which cover 150° extent in longitude. The result shows that the ssc rise time on the daylight side of the earth is shorter than that on the night side. This may be interpreted by transit-time differences of hydromagnetic waves, which are generated by the impact of the solar plasma flow on the geomagnetic field, from the geomagnetic cavity boundary down to the earth in various propagation paths. It is estimated from the ssc rise times in the nighttime that an effective size of the geomagnetic cavity in the antisolar direction at the time of ssc may be of the order of 17 ~ 26 earth radii. (auth)

34667 GEOMAGNETIC LATITUDE DEPENDENCE OF ELECTRON TEMPERATURE IN THE IONOSPHERE. K. Hirao. J. Geomagnet. Geoelec., 14: 208-12(1963). (In English)

From the data obtained at Akita, Wallops, and Fort-churchill, the electron temperature distribution depending to geomagnetic latitude is discussed. Electron temperature patterns in both quiet and disturbed days show that the electron temperature is affected by corpuscles as well as the solar x rays. The effect is remarkably seen in the ionosphere at Wallops that is in 49°N in geomagnetic latitude. (auth)

34668 THE NORTHWARD SHIFTING OF THE GEOMAGNETIC DIPOLE AND STABILITY OF THE AXIAL MAGNETIC QUADRUPOLE OF THE EARTH. Takesi Nagata and Tsuneji Rikitake (Tokyo Univ.). J. Geomagnet. Geoelec., 14: 213-20(1963). (In English)

The g_2^0 term of spherical harmonic expansion of the secular variation in the geomagnetic field amounts to $-21.5\ \gamma$/yr which is the largest among all harmonic terms. Geometrically, this term represents the northward shifting of the geomagnetic axial dipole field. An attempt is made to interpret the g_2^0 variation as a simple harmonic oscillation of the geomagnetic axial quadrupole field S_2^0 within the geomagnetic dynamo system. Result of a simplified theory shows that the S_2^0 field can make a simple harmonic oscillation of 10^2 year in period. (auth)

34669 ELECTRONS FROM BOMB NEUTRON DECAY. John Killeen (Univ. of California, Livermore), Wilmot N. Hess, and Richard E. Lingenfelter. J. Geophys. Res., 68: 4637-43(Aug. 15, 1963).

Calculations were made of the initial electron distribution in space resulting from decay of neutrons emanating from a point source outside the earth's atmosphere. The albedo of neutrons from the earth's atmosphere and partial thermalization produces an important part of the electrons. About 80% of the neutrons incident on the atmosphere are reflected. Since approximate normalization to the Starfish explosion shows that fluxes of less than 10^7 electrons/cm^2/sec are expected initially near the explosion site, this source does not contribute a large fraction of the observed artificial radiation belt. (auth)

34670 ENHANCEMENT OF COSMIC NOISE AT 18 MEGACYCLES PER SECOND FOLLOWING THE STARFISH TEST. F. Glover (Manila Observatory, Philippines), W. R. Steiger, and J. W. Warwick. J. Geophys. Res., 68: 4659-63 (Aug. 15, 1963).

Low-latitude 18-Mc radiometer observations of the high-altitude nuclear test explosion of July 9, 1962, are reported. The stations were Baguio City, Philippines; Honolulu, Hawaii; and Boulder, Colorado, at geomagnetic latitudes 5, 21, and 49°N, respectively. No effects, neither absorption near the time of the explosion nor subsequent emission, appeared at Boulder. Enhancements by factors of 2.0 and 1.1 over the normal galactic level were observed at Baguio and Honolulu, respectively, at 2100 hours sidereal time and within a broad area of the sky centered near +10° declination. The corresponding decay rates were about 1 and 2 months. The low-latitude decay was significantly more rapid at 18 than at 30 Mc as previously reported. (auth)

34671 RADIO WAVE ABSORPTION IN THE AURORAL IONOSPHERE. Roy P. Basler (Univ. of Alaska, College). J. Geophys. Res., 68: 4665-81(Aug. 15, 1963).

The temporal and spatial morphology of the aurorally associated ionospheric absorption of cosmic radio noise is described, using the results of an analysis of the riometer data collected in Alaska over a 5-yr period. The observed daytime and winter maximums of absorption are interpreted as reflecting the temporal variation of the bombardment of the upper atmosphere by primary auroral particles. On the basis of the observed latitude variation of absorption, the auroral absorption zone defined with a maximum at College (geomagnetic 64.65°) was found to be south of the analogous visual auroral zone. The absorption zone is believed to represent the latitude variation of the energy flux of the

incoming stream of auroral particles. The temporal and spatial characteristics of auroral absorption are related to magnetic activity and to the luminous aurora. (auth)

34672 THE EFFECT OF MAGNETIC STORMS ON AROUND-THE-WORLD HIGH-FREQUENCY PROPAGATION. R. B. Fenwick and O. G. Villard, Jr. (Stanford Univ., Calif.). J. Geophys. Res., 68: 4683-8(Aug. 15, 1963).

Experimental studies of around-the-world (RTW) high-frequency propagation at Stanford, California, provided data on the correlation of RTW signal MUF, LUF, and presence (or absence) with the magnetic index K_p. A clear positive correlation of LUF with K_p and a negative correlation of MUF with K_p were noted. Similarly, when K_p is comparatively large, RTW propagation tends to be absent entirely. Detailed study of the effect of magnetic storms on RTW propagation suggests a destruction of normal mode structure rather than an increase of absorption and a decrease of ionospheric critical frequencies. (auth)

34673 AUTOMATIC MAPPING OF THE GEOMAGNETIC FIELD. Joseph C. Cain (Goddard Space Flight Center, Greenbelt, Md.) and James R. Neilon. J. Geophys. Res., 68: 4689-96(Aug. 15, 1963).

Spheric harmonic representations were used to illustrate the application of the U. S. Weather Bureau machine-mapping system for drawing charts of the geomagnetic field. This technique is also applied to the representation of model S_q fluctuations by maps of electric current flow in the ionosphere. (auth)

34674 EFFECTS OF INELASTIC COLLISIONS UPON ELECTRICAL CONDUCTIVITY AND ELECTRON HEATING IN THE LOWER IONOSPHERE. Saul Altshuler (Space Tech. Labs., Inc., Redondo Beach, Calif.). J. Geophys. Res., 68: 4707-16(Aug. 15, 1963).

A detailed investigation of the theory describing the electromagnetic perturbation of a weakly ionized plasma such as the atmospheric D region demonstrates the existence of a generalized momentum transfer cross section for the drift velocity that reduces to the ordinary momentum transfer cross section for elastic processes. However, the drift velocity in the case of air is still determined only by the elastic momentum transfer cross section, since the inelastic differential cross sections are small. It is also shown how inelastic collisions of electrons determine the electron cooling law, and a new result describing the way the average electron loses energy is established. It is a generalization of the approximate description always employed in cross-modulation experiments. Apart from the assumption of a Maxwellian velocity distribution for the electrons, the new result is exact, and it is shown how the mean energy loss per collision is related to the energy-dependent excitation cross section. In the case of nitrogen molecules the effective energy relaxation time, $(G\nu)^{-1}$, varies as the square root of the electron temperature. This result is applied to show how a dielectric discontinuity or electromagnetic mirror may be induced in the D layer by ground-based high-powered transmitters. (auth)

34675 SCATTER FROM MAN-MADE IRREGULARITIES IN THE IONOSPHERIC D REGION. J. H. Gardner (Space Tech. Labs., Redondo Beach, Calif. and Brigham Young Univ., Provo, Utah). J. Geophys. Res., 68: 4717-21(Aug. 15, 1963).

The possibility of utilizing irregularities produced in the ionospheric D layer by radiofrequency heating or by intense optical radiation from lasers to scatter radio waves is considered. Intense beams through the D region can produce large horizontal gradients in electron density where the beam intensity is falling off rapidly. The mechanism in the case of radiofrequency is enhancement of electron attachment rate due to electron heating and in the case of lasers is photodetachment. In these regions radio waves may be scattered from blobs produced by turbulent mixing. A recently discovered anomalous relation between electron energy and electromagnetic field intensity gives rise to the additional possibility of producing sharp vertical gradients in the propagation characteristics of an intense high-frequency wave in a plasma. Some interesting applications to forward scatter propagation links and to ionospheric research with the Arecibo radar are suggested. (auth)

34676 SELECTED GEOMAGNETIC AND SOLAR DATA. J. Virginia Lincoln, ed. (National Bureau of Standards, Boulder, Colo.). J. Geophys. Res., 68: 4863(Aug. 15, 1963).

Data on quiet days, disturbed days, 3-hr range indexes, preliminary magnetic character figures, magnetic character figures, average amplitudes, and provisional sunspot number are tabulated. (P.C.H.)

34677 SYNCHROTRON RADIATION DECAY AT EQUATORIAL SITES. S. C. Goldman (Aerospace Research Inc., Boston) and S. Horowitz. J. Geophys. Res., 68: 4865(Aug. 15, 1963).

Riometer data collected at Addis Ababa, Ethiopia, and Accra, Ghana, have shown a slow change in measured noise intensity that is apparently due to the decay of the synchrotron radiation generated by an artificial electron belt. (P.C.H.)

34678 A NOTE ON CONTOURS IN $\underline{B}$, $\underline{L}$ SPACE. F. L. Keller and J. I. Vette (Aerospace Corp., El Segundo, Calif.). J. Geophys. Res., 68: 4866-8(Aug. 15, 1963).

The slope of contour lines in $\underline{B}$, $\underline{L}$ space at the invariant geomagnetic equator is considered in terms of the derivatives of the contours in invariant $\underline{R}$, λ space. (P.C.H.)

34679 AN ISOLATED OBSERVATION OF THE SYNCHROTRON RADIATION ASSOCIATED WITH THE JULY 9 NUCLEAR EXPLOSION. Roy P. Basler (Univ. of Alaska, College). J. Geophys. Res., 68: 4869(Aug. 15, 1963).

Observation of the synchrotron radiation and radiowave absorption produced by bomb-generated electrons from off the coast of Chile is reported. The noise received increased to about 0.7 db above the normal cosmic noise level starting about 5 min after the explosion. Subsequently there was approximately 0.3 db of absorption, but within the next 20 or 30 min the trace returned to its normal level and showed neither absorption nor enhancement of the noise level afterward. (P.C.H.)

34680 ON THE POWER SCATTERED FROM DENSITY FLUCTUATIONS IN A PLASMA. D. R. Moorcroft (Stanford Univ., Calif.). J. Geophys. Res., 68: 4870-2(Aug. 15, 1963).

A previously derived expression for the scattered spectrum in the absence of a magnetic field and in the absence of collisions was numerically integrated on a digital computer to see whether the assumptions used in deriving the equation $\sigma/N = [(kD)^2/1 + (kD)^2] + \{1/[1 + (kD)^2][1 + (kD)^2 + T_e/T_i]\}$ led to any serious discrepancies. T_e and T_i are the temperatures of the electrons and the ions, $D = (KT_e\epsilon_0/Ne^2)^{1/2}$ is the Debye length for the electrons, $k = (4\pi/\lambda)\cos(\phi/2)$, ϕ is the angle between the paths from the scattering volume to the transmitter and receiver ($\phi = 0$ for backscattering), λ is the transmitted wavelength, N is the electron density, and σ_e is the power scattered by single, free electron. The results were compared with the equation for the condition $kD \ll 1$, which is valid for all the present ionospheric and magnetospheric observations. (P.C.H.)

34681 THE IONIZATION STRUCTURE OF PLANETARY NEBULAE. I. PURE HYDROGEN NEBULAE. D. G. Hummer and M. F. Seaton (University Coll., London). Monthly Notices Roy. Astron. Soc., 125: 437-59(1963).

The problem is formulated in terms of the equations of radiative transfer, of ionization equilibrium and of the thermal balance. The intensity of ionizing radiation is $I_\nu = I_\nu^s + I_\nu^d$, where I_ν^s is the attenuated intensity of stellar radiation and I_ν^d the intensity of diffuse radiation produced in the nebula. In Approximation I it is assumed that there is no transfer problem for the diffuse radiation, emission and absorption occurring at the same place. The problem is then solved using a method due to Zanstra and de Jong. Assuming the star to radiate as a black body, numerical results are obtained for a wide range of star temperatures. In Approximation II the transfer equation for I_ν^d is solved using the source function from Approximation I. For an isothermal plane parallel model it is found that the mean intensities J_ν, as given by Approximations I and II, never differ by more than a few per cent. (auth)

34682 THE IONIZATION STRUCTURE OF PLANETARY NEBULAE. II. COLLISIONAL COOLING OF PURE HYDROGEN NEBULAE. D. G. Hummer (University Coll., London). Monthly Notices Roy. Astron. Soc., 125: 461-8 (1963).

Collisional excitation and ionization of hydrogen are mechanisms which lead to the removal of energy from planetary nebulae. The ionization and thermal balance equations including these effects are solved for a pure hydrogen nebula to determine the electron temperature in the nebula for a wide range of star temperatures. For reasonable stellar fluxes the electron temperature considered as a function of star temperature assumes a maximum value of 2×10^4°K. Collisional excitation greatly enhances the line emission from low-lying states of hydrogen; in particular, it may be important to allow for collisional excitation of Ly α when one obtains star temperatures from estimates of the total energy radiated by the nebula. The role of hydrogen collisional cooling in real nebulae is discussed briefly. Accurate and convenient expressions are obtained for the collisional excitation and ionization rates for hydrogen. (auth)

34683 THE ATMOSPHERE OF KAPPA PAVONIS. I. A COARSE ANALYSIS. A. W. Rodgers and R. A. Bell (Australian National Univ., Canberra and Univ. of Adelaide). Monthly Notices Roy. Astron. Soc., 125: 487-527(1963).

High dispersion spectra obtained at 12 phases of the cepheid κ Pavonis are analyzed by curve of growth methods, and the variations in atmospheric parameters determined. Density fluctuations take the form of a longitudinal compression pulse, amplitude ratio 10^4, and duration 0.4 P, superimposed on a regular pulsation probably associated with the gross motion of the atmosphere. Assuming that $\theta_{ion} = \theta_{exc} - 0.15$, abundance determinations of 30 elements are made which indicate that e-process elements are deficient by a factor of 3 and the s-process elements by 23 with respect to the Sun. The results strengthen the previously held opinion that κ Pavonis is a member of the disk population. (auth)

34684 PREDICTION OF FUTURE SUNSPOT CYCLES. D. G. King-Hele (Royal Aircraft Establishment, Farnborough, Eng.). Nature, 199: 226-7(July 20, 1963).

Attention is directed to a 7-cycle recurrence tendency in the rise-time of sunspots and to the possible use of this tendency in prediction. Rise-time values for each of the past 15 cycles are plotted against the year in which maximum sunspot activity occurred. Expressing rise-time as a fraction of the total cycle-length, values for the next two sunspot cycles are predicted. (H.M.G.)

34685 OCCULTATION THEORY OF JOVIAN RADIO OUTBURSTS. Alex G. Smith, N. F. Six, T. D. Carr, and G. W. Brown (Univ. of Florida, Gainesville and Universidad Chile, Santiago). Nature, 199: 267-8(July 20, 1963).

According to Strom, the Jovian ionosphere could act as a gigantic spherical lens to focus energy on the Earth when discrete sources or radio stars are temporarily occulted by Jupiter. The authors point out that there are a number of discrepancies in the Strom theory such as: the lack of a systematic relation between angular speed and noise storm duration, failure of the relative intensities of the different frequencies to vary with the Earth-Jupiter distance, and flux density data. It is concluded that observations made by the authors do not lend support to the occultation theory of Jovian outbursts. (H.M.G.)

34686 FREQUENCY DRIFT AND TIME PROFILE OF 200 Mc/s BURSTS OF TYPE III AND THE ELECTRON TEMPERATURE OF THE CORONA. Oeystein Elgaroey and Harald Roedberg (Univ. of Oslo). Nature, 199: 268 (July 20, 1963).

Frequency drift velocity determinations on type III solar bursts were made from high-resolution swept-frequency observations at the Oslo Solar Observatory. No bursts were observed with frequency drift velocities less than -20 Mc/sec^2. The total number of bursts included in the analysis was 68. Wild found that frequency drift velocity was approximately proportional to the frequency and was given by $df/dt = -f/k$, where k was a constant that varied from one burst to the next. Inserting the observed mean value of df/dt in Wild's empirical equation, and using 215 Mc/sec as the center frequency of the observing range, k was found to be 3.6 ± 0.6. Electron temperature of the corona was found to be 2.1×10^6 °K. The time profile of 200 Mc/s bursts of type III was also determined. (H.M.G.)

34687 BALL LIGHTNING. E. R. Wooding (University Coll. of Wales, Aberystwyth, Eng.). Nature, 199: 272-3 (July 20, 1963).

An explanation of the phenomenon of ball lightning is presented. It is suggested that the lightning ball consists of a plasma vortex ring. Aspects of the phenomenon are explained in view of the vortex ring theory. (H.M.G.)

34688 A GENERALIZATION OF THE PHASE-LAW OF LUNAR GEOMAGNETIC TIDES. Otto Schneider (Instituto Antártico Argentino, Buenos Aires). Nature, 199: 548-50 (Aug. 10, 1963).

The cause of lunar geomagnetic variations is considered. It is pointed out that the variations are believed to be caused by lunar diurnal motion of ionospheric layers. The electric conductivity of these layers is believed to vary with solar time in such a way that a maximum is reached about local noon, with low values prevailing during the night hours. A general scheme is presented to represent the daily variation of conductivity as a function of solar time t involving terms both in sin t and cos t. (C.H.)

34689 IMPLICATIONS OF SIMILARITY IN RARE-EARTH FRACTIONATION OF NAKHLITIC METEORITES AND TERRESTRIAL BASALTS. R. A. Schmitt and R. H. Smith (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Nature, 199: 550-1(Aug. 10, 1963).

The absolute abundance of 14 rare earth elements, Y, and Sc was determined by neutron activation analysis in two nakhlitic achondrites. Normalized abundances were compared with data for 16 chondritic meteorites, 3

calcium-poor achondrites, 3 calcium-rich achondrites, and terrestrial basalts. The possibility is discussed of a lunar origin of meteorites, with volcanic action on the moon causing the smooth fractionation so similar to terrestrial basalts. (C.H.)

34690 RADIOGENIC AND ATMOSPHERIC ARGON CONTENT OF TEKTITES. J. Zaehringer and W. Gentner (Max-Planck-Institut für Kernphysik, Heidelberg). Nature, 199: 583(Aug. 10, 1963).

The age of tektite samples from a number of locations was determined by measurement of the K/Ar ratio. In addition to the age determinations, bubble-rich specimens were investigated for excess gases of other than radiogenic origin. By cracking the samples in an ultrahigh vacuum it was found that these gases are mainly included in the bubbles. The characteristic values of Ar^{40}/Ar^{36} found indicated that these gases are of terrestrial origin. The high pressure found in some bubbles also indicates that tektites were molten close to the surface of the earth. It is concluded that tektite material itself is of terrestrial origin. (C.H.)

34691 MHD WAVES IN THE EARTH'S ENVIRONMENT. P. C. Clemmow (Univ. of Cambridge, Eng.). New Scientist, 19: 297-9(Aug. 8, 1963).

The properties of magnetohydrodynamic waves are described, and their potential usefulness to ionospheric research and in determining the electrodynamics of the Earth's environment is discussed. (C.E.S.)

34692 NEW EVIDENCE FOR LONG-LIVED SOLAR STREAMS IN INTERPLANETARY SPACE. D. A. Bryant, T. L. Cline, U. D. Desai, and F. B. McDonald (Goddard Space Flight Center, Greenbelt, Md.). Phys. Rev. Letters, 11: 144-6(Aug. 15, 1963).

Explorer XII measurements of the intensity of interplanetary protons of energy greater than 3 Mev are discussed as possible evidence for long-lived solar streams in interplanetary space. The intensity variations of the protons are related to several solar and geophysical disturbances. (C.E.S.)

34693 SYNTHESIS OF 4N- AND THEIR NEIGHBORING NUCLEI BY THE RAPID NUCLEAR PROCESS. Hiroyuki Tsuji (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 29: 699-711(May 1963). (In English)

It is investigated whether or not the nucleogenesis in the range $A = 20 \sim 40$ is carried out in terms of the proton capturing process in the outer layer of a supernova envelope. The reaction rates induced by protons and α particles are calculated for density $(10^{-5} \sim 1)$ g/cm^3 at temperature $(0.5 \sim 1.5) \times 10^9$K. As its result, it is found that the α-particle reactions are of negligible effects for the synthesis of elements in the range of interest. If the explosion time of a supernova may be assumed to be $(2 \sim 5) \times 10^3$ sec, it is indicated that the relative abundances of the 4N-nuclei, Ne^{20}, Mg^{24}, Si^{28}, S^{32}, Ar^{36}, and Ca^{40} can be explained by the proton capturing process starting from Ne^{20} alone. (auth)

34694 ELECTRODYNAMICS IN THE EXPANDING UNIVERSE. Hidekazu Nariai and Toshiei Kimura (Hiroshima Univ.). Progr. Theoret. Phys. (Kyoto), 29: 915-32 (June 1963).

Electrodynamics in the expanding universe is investigated as a part of the program of research on whether the quantum field theory and general relativity can coexist or not. The Green's functions of the electromagnetic field in the expanding universe are obtained in the radiation gauge and the generalized Lorentz gauge. With the aid of these Green's functions, it is concluded that, in contrast with the case of gravitons, photons do not suffer from the difficulty of the breakdown of macroscopic causality and that the ponderomotive equation does not contain a tail term in the sense of De Witt and Brehme's theory. Some remarks are also given on a type of space-times in which the tail term does not appear. The quantization of the electromagnetic four-potential subjected to the generalized Lorentz condition is carried out by making use of Peirls' method. (auth)

34695 EFFECTS OF SCATTERING IN THE FAR ULTRA-VIOLET BY INTERSTELLAR HYDROGEN AND HELIUM. A. H. Cook. Quart. J. Roy. Astron. Soc., 4: 203-16(June 1963).

It is shown how the profile of absorption of Lyman-α due to scattering by interstellar atomic hydrogen may be predicted from 21-cm observations and predictions are made of the stars and galaxies that might be seen in L-α. Scattering by molecular hydrogen is discussed and it is shown how quantities of H_2 in interstellar space might be determined from observations at about 1100 Å on O and B stars. Finally, the effect of He is estimated. (auth)

34696 CORONAL EXPANSION AND SOLAR CORPUSCULAR RADIATION. E. N. Parker (Univ. of Chicago). 21p. (CONF-77-7)

From Symposium on Plasma Space Science, Washington, D. C., June 1963.

Investigations of the existence and source of solar corpuscular radiation were reviewed. The hydrodynamic properties of the solar corona were investigated due to the continuing nature of the solar corpuscular radiation and the enormous extent of the coronal temperature and density into space. It is concluded that the corpuscular radiation is probably the manifestation of coronal expansion. The mechanisms of coronal expansion and their effects on the interplanetary magnetic fields were discussed. Enhanced corpuscular radiation due to the increased rate of coronal expansion was also considered. (C.E.S.)

34697 SOLAR PROTON EXPERIMENTS. K. W. Ogilvie (Goddard Space Flight Center, Greenbelt, Md.). 50p. (CONF-77-8)

From Symposium on Plasma Space Science, Washington, D. C., June 1963.

Experiments on solar particles since 1960 are discussed. Abundance of the solar cosmic rays is treated, but the main emphasis is upon the energy region between 1 and 30 Mev. The significance of the exponential rigidity form for the spectrum of solar protons is discussed, and some results from rocket observation of Nov. 1960 events are presented. Observation of increases in the solar proton flux at the time of the sudden commencement is discussed, and observations of cut-off changes by Injun I are briefly treated. (auth)

Cosmic Radiation

34698 (AFOSR-60-13) STUDY OF THE TIME VARIATIONS AND SOLAR MODULATIONS. Final Technical Report. Ismael Escobar V. (Universidad Mayor de "San Andres," La Paz, Bolivia. Laboratorio de Fisica Cosmica de Chacaltaya). Oct. 1962. 39p.

Data on the time variation of cosmic rays obtained at Mt. Chacaltaya, Bolivia, with a neutron monitor and an East- and West-pointing telescope are given. The Forbush decreases observed are discussed in relation to the preceding solar disturbances, and the solar daily variation data are compared with University of New Mexico results obtained with underground inclined telescopes. Explanation of the

results in terms of solar modulation of cosmic ray intensity is considered. (D.C.W.)

34699 (NYO-10273) ON THE MODULATION OF COSMIC RAY NUCLEI WITH Z > 2 DURING THEIR PROPAGATION. M. V. Krishna Appa Rao (Rochester, N. Y. Univ.). June 27, 1963. Contract AT(30-1)-875. 14p.

The effect of spallation and ionization loss on the relative abundances and energy spectra of cosmic-ray nuclei of charge greater than two, during their propagation in the interstellar and interplanetary space, has been determined. Comparison of the results with experimental observations indicate that cosmic-ray nuclei travel an amount of interstellar hydrogen proportional to $(\epsilon^2 - 1)^{-x}$, (where ϵ is the total energy of the nuclei in terms of their rest mass) with x between 0.16 and 0.25 and with the high-energy nuclei ($\epsilon = 4$) traversing 2 to 2.5 gms/cm^2 of interstellar hydrogen. (auth)

34700 (TT-1080) THE INFLUENCE OF THE EARTH'S MAGNETIC FIELD ON LARGE AUGER ELECTRON SHOWERS. V. V. Vladimirskii. Translated by D. A. Sinclair (National Research Council of Canada, Ottawa) from Zh. Eksperim. i Teor. Fiz., 18: 392-401(1948). 16p.

The spectrum of the bremsstrahlung produced by fast electrons moving in the earth's magnetic field is examined. The influence of the cascades produced by the bremsstrahlung in the atmosphere on the total number of particles in auger showers produced by electrons is determined. At primary electron energies greater than 2×10^{18} ev, the bremsstrahlung gives rise to more particles at sea level than does the primary electron after it has been slowed down by the magnetic field. (auth)

34701 THE RADIATION ENVIRONMENT OF INTERPLANETARY SPACE. John H. Shaw (Ohio State Univ., Columbus). Appl. Optics, 1: 87-95(Mar. 1962).

The spectral distribution and intensity of the radiation fluxes from various sources contributing to the radiation environment of interplanetary space are discussed. The radiation from both the quiet and disturbed sun is described in some detail, and current estimates of radiation from other sources are given. (auth)

34702 OCCURRENCE OF A SHORT-LIVED INCREASE IN RADIATION INTENSITY DETECTED ON AUGUST 20, 1960 IN THE SECOND SPUTNIK. L. V. Kurnosova, L. A. Razorenov, and M. I. Fradkin. Iskusstv. Sputniki Zemli, Akad. Nauk SSSR, No. 15, 66-70(1963). (In Russian)

Data obtained during the flight of the second Sputnik on an increase in the intensity of radiation due to charged particles are presented. This increase was noted on August 20, 1960, at 7 hours and 40 minutes world time. The detection instrument consisted of a telescope of two rows of gas-discharge counters with a geometry factor of 2.5×10^{-4} m^2 sterad and a resolution time of 2×10^{-5} seconds. The increase was noted when the ship was in the northern hemisphere in the latitudes 50 to 60°. It was not registered at other times when the ship passed through approximately the same geographical region. It was therefore concluded that the rise in radiation was due to a flare of particles from the sun and not to traversal through a radiation belt. This conclusion was also supported by an increase in detection of particles with atomic numbers greater than five. The counting rate of particles with Z greater than 5 was found at this time to be 4.0 ± 1.4 particles/minute as compared to an average count of 0.7 ± 0.1 particles/minute. It is pointed out that the sun was active at the time of the flight of the second Sputnik and in fact a flare of intensity 2^+ had died down just before the increase in radiation was noted. A chance coincidence of these two events has a probability of not more than 0.06. (TTT)

34703 MEASUREMENT OF THE RADIATION DOSES RECEIVED BY Yu. A. GAGARIN AND G. S. TITOV AT THE TIME OF THE FIRST COSMIC FLIGHTS. I. B. Keirim-Markus, E. E. Kovalev, N. A. Sergeeva, and L. N. Uspenskii. Iskusstv. Sputniki Zemli, Akad. Nauk SSSR, No. 15, 102-3(1963). (In Russian)

The radiation doses obtained by Gagarin and Titov during their flights are presented. Three types of luminescent dosimeters were used, one with no filter, another with 1.3 mm of Pb, and the third was 3.2 mm of Al. These dosimeters could be used for protons ranging from 10 to 1000 Mev. Photodosimeters were also used to detect gamma rays and neutrons. Control dosimeters were kept on the ground during the flights. The luminescent doses are displayed in a table; without filters, the readings were 1.6 mrad for Gagarin and 12.0 mrad for Titov. The results obtained for the Titov flight were found to be almost the same as those obtained during the 25-hour flight of the second cosmic space ship. In each case the bremsstrahlung energy inside the cabin was found to be 10^5 ev. It was concluded that this radiation was accumulated when the ship passed through the outside radiation belt while traversing the South Atlantic anomaly and high latitudes. The electron energy excited by the bremsstrahlung was found to be no less than 0.5 to 1.0 Mev. Gagarin's dose was of course found to be much less because of his shorter flight. His average radiation dose was 2 ± 1 mrad. (TTT)

34704 COSMIC-RAY DIURNAL VARIATION WITH PHASE INVERSE TO USUALLY OBSERVED PHASE. K. Murakami and S. Kudo (Inst. of Physical and Chemical Research, Tokyo). J. Geomagnet. Geoelec., 14: 177-82 (1963). (In English)

The phase of the diurnal variation of cosmic-ray intensity that occurred on Dec. 23, 1957 is directed to the anisotropy near 6 hr in local time. After the investigation of five similar examples, it is concluded that these diurnal variations with inverse phase appear on the geomagnetically quiet days after the occurrence of Type IV solar radio outburst. (auth)

34705 RELATION BETWEEN COSMIC-RAY DIURNAL VARIATION AND TYPE IV SOLAR RADIO OUTBURST. K. Murakami and S. Kudo (Inst. of Physical and Chemical Research, Tokyo). J. Geomagnet. Geoelec., 14: 183-90 (1963). (In English)

Diurnal variation of cosmic ray intensity is often enhanced during cosmic ray storm. So it may be supposed that the diurnal variation is caused directly by some matter emitted from the sun at the time of Type IV solar radio outburst. The frequency distributions of amplitude of diurnal variations classified in many cases are obtained, and it is concluded that a part of diurnal variations has more direct relation to Type IV outburst than with solar flare, cosmic ray storm, or geomagnetic distrubance. Furthermore, the time variation of the frequency distribution is compared with those of different quantities on cosmic rays, Type IV outburst, or the others. The amplitude of diurnal variation seems to depend on the condition in interplanetary space where modulation mechanism is triggered by the matter emitted from the solar disk at the outbreak of Type IV outburst. (auth)

34706 THE EAST-WEST ASYMMETRY OF COSMIC RAYS WITH HIGH ENERGY AND POSITIVE EXCESS. Yoshiko Kamiya (Nagoya Univ., Japan). J. Geomagnet. Geoelec., 14: 191-7(1963). (In English)

A considerably large east-west asymmetry of cosmic radiation with high energy was observed using two narrow angle counter telescopes with alt-azimuth mountings at Nagoya. This observation is interpreted as the result of deflection by earth's magnetic field of the μ-mesons produced from primary particles in the atmosphere. Since this component contains about twenty percent more positive than negative mesons, the asymmetry was explained in terms of the opposite deflection for positive and negative mesons and their finite lifetimes. The asymmetry calculated theoretically in this way agrees with the observed data. (auth)

34707 MULTIPLE MESON PRODUCTION IN NUCLEON-NUCLEON INTERACTIONS AT ENERGIES AROUND 200 Gev. Masaomi (Takahata) Ohta (Osaka City Univ.). J. Phys. Soc. Japan, 18: 936-44(July 1963).

The interactions considered as collisions between nucleons with the primary energies of the order of 100 Bev are analyzed. The average values of P_T,(P_T), are obtained for individual showers. A shower whose value of (P_T) is exceptionally small, i.e., 0.11 Bev/c, is found. The energy distribution of secondary particles has the form of inverse square distribution, except for the lowest energy interval. The average value of energy has a tendency to increase slowly with increasing primary energy, though it is nearly constant up to 200 Bev. The individual angular distribution of secondary particles in the center-of-mass system seems to differ from event to event, but the overall distribution can be expressed in the form $F(\cos\theta^*) = 1 + k\cos^2\theta^*$, $k = 5.2 \pm 2.0$. (auth)

34708 ON THE HEAVY PRIMARY COSMIC RAY INTERACTIONS IN NUCLEAR EMULSIONS. Yasuko Maeda (Kobe Univ., Japan). J. Phys. Soc. Japan, 18: 945-54(July 1963).

The interactions of heavy primary particles in cosmic rays are analyzed by the method of nuclear emulsions. From this analysis, some characteristics of nuclear structure are obtained. The ratio of the number of fragment alpha particles to that of fragment protons produced by incident heavy primaries (Z between 6 and 9) is about 0.37 for $N_h \leq 7$ events, and this value is in good agreement with the results of other experiments. The transparency of medium nucleus is estimated to be about 30%. The relation between incident energies and average number of produced mesons is compared with other accelerator data. The experimental results are well interpreted from the view that the medium nucleus having charge 6 to 9 is constructed from a group of some complete helium nuclei if the charge of medium nucleus is even (alpha particle model), while the odd charged medium nucleus is composed of some helium nuclei and a helium nucleus accompanied by an extra proton. (auth)

34709 EMPIRICAL FORMULA FOR RANGE SPECTRUM OF COSMIC RAY μ MESONS AT SEA LEVEL. Saburo Miyake (Osaka City Univ.). J. Phys. Soc. Japan, 18: 1093(July 1963).

An analytical expression of the range spectrum for cosmic mesons (μ) as a simple function of depth is presented. An average density of 3.02, average Z of 12.9, and average Z/A of 0.49 were used as the characteristics of standard rock. It is also assumed that there is no latitude effect for large range mesons (μ). Under the condition of 50° geomagnetic latitude and standard rock an equation for vertical intensity is obtained that is expected from the production spectrum of parent mesons, their decay probability, and nonlinear relation between energy and range at great depth. The agreement between the equation and experimental data is quite good. (C.E.S.)

34710 DISTRIBUTION OF PRODUCTION HEIGHT OF EXTENSIVE AIR SHOWERS. Saburo Miyake, Tatsunosuke Kaneoko, and Nobuo Ito (Osaka City Univ.). J. Phys. Soc. Japan, 18: 1094(July 1963).

Neglecting fluctuations of inelasticity in collisions, the production height of extensive air showers (EAS) was determined from both the age parameter and total size at the observed level using transition curves for various incident energies. A transition curve of 10^{13} ev was used. This new estimation seems to be more reasonable than an estimation using single cascade models. (C.E.S.)

34711 DETERMINATION OF THE RELATIVE INTENSITY OF THE DIFFERENT TYPE OF ATOMIC NUCLEI IN THE PRIMARY COSMIC RAYS ON THE BASE OF THE MAXIMUM LIKELIHOOD METHOD. Éva Gombosi and Lajos Jánossy. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 11: 163-74(1963). (In Hungarian)

A method was worked out for the relative abundance of the different type of atomic nuclei of the cosmic rays at the top of the atmosphere, on the basis of the maximum likelihood estimation. (auth)

34712 SIMULTANEOUS SAMPLING OF COSMIC RADIATION AT DIFFERENT ALTITUDES. V. D. Hopper, Jean E. Laby, J. G. Sparrow, and E. L. Unthank (Univ. of Melbourne). Nature, 199: 271-2(July 20, 1963).

A technique for obtaining simultaneous measurements of cosmic radiation at two different altitudes has been developed. The method consists of suspending two packets of nuclear emulsion plates from one balloon, while maintaining a constant vertical separation of 10,000 to 27,000 ft between the packets. The separation has been maintained throughout level balloon flights up to four hours duration. This technique is of value in the investigation of the variation in cosmic radiation with altitude. (auth)

34713 SOLAR-FLARE PROTON DATA. W. R. Webber (Univ. of Minnesota, Minneapolis). Nucleonics, 21: No. 8, 154-7(Aug. 1963).

The intensities of galactic cosmic ray and solar proton fluxes are compared, and information on the occurrence of solar flares producing major bursts of radiation is given. The properties of typical flares (rise time, etc.) and of the resultant radiation (energy, etc.) are discussed, and solar proton data including radiation doses are shown for major solar outbursts for 1956-1961. (D.C.W.)

34714 VERY HIGH-ENERGY COSMIC RAYS. C. E. Fichtel (Goddard Space Flight Center, Greenbelt, Md.). Phys. Rev. Letters, 11: 172-3(Aug. 15, 1963).

A model for the change in composition of cosmic particles at $\sim 10^{16}$ ev is considered. The model is based on the proposition that spiral-arm segments in the galaxy may be an important controlling feature. This model accounts for the fact that primary particles of total energy $\geq 10^{17}$ ev are nearly all protons and that heavy nuclei are less abundant than at lower energies. (C.E.S.)

34715 ESTIMATE OF NEUTRON ALBEDO ON THE MOON'S SURFACE RESULTING FROM COSMIC RADIATION. M. V. K. Appa Rao (Univ. of Rochester, N. Y.). Science, 141: 530-1(Aug. 9, 1963).

Nuclei on the surface of the moon undergo spallation yielding various radioactive nuclei as well as neutrons, some of which constitute an albedo. Estimation of neutron albedo requires knowledge of intensity and composition of cosmic radiation, composition of the moon's surface, and

cross section for the production of neutron albedo. Neutron albedo for basaltic rock, for elemental components of basaltic rock, and for chondritic rock is given. (H.M.G.)

34716 EXTREME INTENSITY INCREASES OF HIGH-ENERGY PARTICLE RADIATION IN THE EXOSPHERE AS OBSERVED BY SPUTNIK III. Robert Knuth (Observatorium fur Ionospharenforschung, Kuhlungsborn, Ger.). Z. Meteorol., 16: 269-71(Sept.-Oct. 1962).

Two channels in the telemetered data from Sputnik III investigated the intensity of high-energy photons over 35 kilo-electron-volt. The data from the period between May 15 and Aug. 16, 1958 (corresponding to flight altitudes between 220 and 950 kilometers) were analyzed. The extreme intensity increases observed were illustrated and are discussed. (OTS)

Criticality Studies

Refer also to abstract 33419.

34717 (CONF-39-69) CRITICAL STUDIES WITH ZPR-III OF A 440-LITER FAST REACTOR CORE CONTAINING URANIUM ENRICHED TO 17%. Allen L. Hess and J. M. Gasidlo (Argonne National Lab., Ill.). [196?]. Contract W-31-109-eng-38. 24p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

A description of ZPR-III Assembly 41 and some of the experiments performed with it, along with the primary details of the fast exponential and the fast-thermal critical system are given. Experiments with steel and aluminum reflectors in the assembly blankets are reported, and their results are compared with reflector savings measurements on the fast exponential and to theoretical calculations. Fission ratios obtained in the three 5:1 systems are compared, as well as central reactivity coefficients from the two critical studies. Experiments concerned with the conversion of uranium-238 to plutonium in EBR-II type blankets are described. (N.W.R.)

34718 (CONF-133-1) COMPARISON OF KAPL CLEAN CRITICAL AND SUBCRITICAL EXPERIMENTS WITH CALCULATIONS. D. R. Bach, S. I. Bunch, J. A. Bistline, R. J. Cerbone, F. Feiner, W. Skolnik, R. E. Slovacek, and S. Weinstein (Knolls Atomic Power Lab., Schenectady, N. Y.). [1962]. Contract [W-31-109-eng-52]. 75p.

For Presentation at IAEA Symposium of Exponential and Critical Experiments with Calculations, Amsterdam, Sept. 1963.

An intensive program of critical and subcritical experiments and associated calculations was conducted on highly enriched, hydrogen-moderated systems. Interest was centered on overall effects such as reactivity, prompt neutron decay constants, and region-wide spectra, and experiments were performed as a function of fuel density, core size, metal to water ratio, and temperature. The effects of theoretical improvements on the agreement between calculations and experiments were studied. The experiments were carried out in the Solid Homogeneous Assembly, Pressurized Test Reactor, pulsed subcritical systems, and a series of subcritical lattices having a volume of 1 cubic foot. The results showed a consistent discrepancy between calculation and experiment in the clean critical experiments, with the calculated reproduction constants being 1 to 3% high. Good agreement was obtained between calculated and measured low-energy spectra in weakly absorbing media but not in highly absorbing media. No consistent discrepancy was observed in the pulsed measurements, but the accuracy was poor. (D.L.C.)

34719 (RFP-325) TWO EXPERIMENTAL SUB CRITICAL ARRAYS OF $Pu(NO_3)_4$ SOLUTION. C. L. Schuske (Dow Chemical Co. Rocky Flats Div., Golden, Colo.). [July 1963]. Contract AT(29-1)-1106. 7p.

Calculations were made of the criticality of $Pu(NO_3)_4$ solutions in two subcritical arrays. An extrapolation of the inverse multiplication curve for a shielded array of 5-in.-dia. tanks of stainless steel indicated that the 5 tanks could be of infinite length and remain subcritical. Results for the 30-in.-dia. Rasching-ring-filled stainless steel tank indicated that the vessel would not be critical at any height. (M.C.G.)

34720 (TID-19011) CRITICAL INTERACTION POTENTIALS OF WATER MODERATED UF_6 ARRAYS. C. E. Newlon (Oak Ridge Gaseous Diffusion Plant, Tenn.). Nov. 30, 1962. Contract W-7405-eng-26. 20p. (KD-1766)

The critical interaction potentials were computed for water moderated UF_6 systems at uranium-235 enrichments between 1 and 90% using the interaction angle method developed at ORGDP. The calculations indicate that significant gains are made in current spacing practices for the storage and shipment of UF_6 containers, particularly in the 5% uranium-235 enrichment region. Results are given for arrays comprised of safe spheres and cylinders of infinite length. (N.W.R.)

Elementary Particles and Radiations

Refer also to abstract 34674.

34721 (CERN-63-26) INTRODUCTION TO MANDELSTAM REPRESENTATION. PART I. POTENTIAL SCATTERING. Andre Martin (European Organization for Nuclear Research, Geneva). July 10, 1963. 47p.

The basic equations for potential scattering are given, and the analytic properties of the Green's function and of the scattering amplitude for fixed momentum transfer and fixed energy are examined. The representation so derived is used with the unitarity condition to obtain the exact scattering amplitude without using the Schrodinger equation. (D.C.W.)

34722 (CONF-46-86) COMPARISON OF MODERATE ENERGY PROTON-PROTON MODELS. Peter Signell and N. R. Yoder (Pennsylvania State Univ., University Park). Contract AT(30-1)-2133. 19p.

From American Physical Society 1963 Spring Meeting, Washington, D. C., Apr. 1963.

The predictions of six recently proposed two-nucleon models are compared to 682 pieces of proton-proton scattering data in the energy range 10–320 Mev. It is found that the value of the poorness-of-fit parameter, χ^2, ranges from four to seventeen times its expected value. (auth)

34723 (EFINS-63-25) SELF-CONSISTENT MODELS OF STRONG INTERACTION WITH CHIRAL SYMMETRY. Yoichiro Nambu and Pedro Pascual (Chicago. Univ. and Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies). Apr. 1963. Contract AT(11-1)-264. 19p.

Some simple models of (renormalizable) meson-nucleon interaction are examined in which the nucleon mass is entirely due to interaction and the chiral (γ_5) symmetry is "broken" to become a hidden symmetry. It is found that such a scheme is possible provided that a vector meson is introduced as an elementary field. (auth)

34724 (EFINS-63-33) THE SYSTEMATICS OF BARYON AND MESON STATES. R. H. Dalitz (Chicago. Univ. En-

rico Fermi Inst. for Nuclear Studies and Chicago. Univ.). [1963]. Contract AT(11-1)-264. 32p. (CONF-131-1)

From Topical Conference on Recently Discovered Resonant Particles, Athens, Ohio, Apr. 1963.

Present information on established and possible baryons and mesons, its derivation, and its organization on the basis of unitary symmetry are discussed. Some questions of particular interest in connection with the last point are considered. 35 references. (D.C.W.)

34725 (ISS-63/27) UN FASCIO DI PIONI DI MOMENTO PARI A 150 Mev/c. (A Pion Beam of 150 Mev/c Momentum). G. Matthiae (Italy. Istituto Superiore di Sanità, Rome). Apr. 20, 1963. 41p.

A magnetic channel set-up at the Frascati electron synchrotron was designed to obtain a pion beam with a momentum up to 150 Mev/c. The requirements on the beam are discussed, and the measurements taken on the magnets are described. (auth)

34726 (ISS-63/34) UNITARITY CONDITION AND CONNECTIONS BETWEEN PION-PION AND PION-NUCLEON SCATTERING. U. Amaldi, Jr. and F. Selleri (Italy. Istituto Superiore di Sanita, Rome). July 1, 1963. 32p.

The relations between elastic and inelastic pion-nucleon scattering are investigated by means of the unitarity condition. For the inelastic processes only the peripheral production of the ρ-meson is considered. The conclusion is reached that the latter process is consistent with unitarity, and positive evidence is obtained for the Ball-Frazer mechanism for the higher pion-nucleon resonances. The elastic differential cross section at 1.2 Bev is calculated and compared with experiment. (auth)

34727 (JINR-E-1294) A MODEL EQUATION FOR NON-ANALYTICAL TRANSITION AMPLITUDES. I. P. Nedialkov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 6p.

Integral equations for transition amplitudes presuppose analytical properties of the amplitude itself, as is the case with equations of Low- and Mandelstam type. An example is given in which the analytics of the amplitude is not obligatory if, instead of integral equations, algebraic ones are used. (auth)

34728 (JINR-P-1242) ASIMPTOTIKA GRAFOV FEINMANA. I. (The Asymptotic Behavior of the Feynman Graphs. [Part] I. A. V. Efremov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 18p.

For some class of the Feynman graphs with a scalar particle, the method of reading off the asymptotic behavior from the topology of the graph is obtained. (auth)

34729 (JINR-P-1269) NEITRINO. (Neutrino). M. A. Markov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 100p.

A review is given on physical phenomena in neutrino beams and on interactions related to neutrino physics. Neutrino processes in nature and neutrino importance in cosmology are discussed, and it is shown that experiments with high-energy neutrino may play an important part in the future theory of elementary particles. 135 references are included. (R.V.J.)

34730 (JINR-P-1290) OB EMPIRICHESKIKH ZAKONOMERNOSTYAKH V BARIONNYKH REZONANSAKH. (On Empirical Regularities of Baryon Resonances). A. L. Lyubimov and Yuan-chang Hsu (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy). 1963. 5p.

The existence of some empirical regularities of the quantum numbers (spin, orbital angular momentum, isotopical spin) and masses of pion–hyperon resonances with strangeness-1 is pointed out. These regularities are analogous to those of the π-N isobars. (auth)

34731 (NYO-10274) SU(3) SYMMETRY SCHEME. A REVIEW. Georges W. London (Rochester, N. Y. Univ.). May 21, 1963. Contract AT(30-1)-875. 28p.

The elements of group theory are derived and applied to the isospin group as an example. Rank two groups, SU(3) in particular, are discussed. The connection to physics is made through the identification of the basis vectors of the different representations with physical states. The mass formula, relating the masses within a multiplet, is derived to first order; and some dynamic predictions of the model are listed. (auth)

34732 (NYO-10276) A CLASS OF LORENTZ INVARIANT HAMILTONIAN MODELS OF INTERACTING PARTICLES. R. Acharya (Rochester, N. Y. Univ.). July 9, 1963. Contract AT(30-1)-875. 13p.

A class of Hamiltonian theories of interacting particles is constructed. The theories satisfy the principle of Lorentz invariance and lead to a nontrivial S-matrix. (auth)

34733 (NYO-10277) ELECTROMAGNETIC PROPERTIES OF STABLE PARTICLES AND RESONANCES ACCORDING TO THE UNITARY SYMMETRY THEORY. A. J. Macfarlane and E. C. G. Sudarshan (Rochester, N. Y. Univ.). July 25, 1963. Contract AT(30-1)-875. 34p.

A theory whose SU_3-invariant strong interactions are perturbed by electromagnetic interactions alone is shown to be obtainable formally by a certain unitary transformation of a theory whose SU_3-invariant strong interactions are perturbed only by charge independent interactions. By exploiting readily available information on the latter theory, relations between the electromagnetic properties of various particles and resonances are derived. While many new results are presented, principal emphasis is on the power of the method and on the recognition of the precise nature of the assumptions necessary for the derivation of results. (auth)

34734 (NYO-10278) NEGATIVE PION CAPTURE FROM REST ON COMPLEX NUCLEI. Richard M. Spector (Rochester, N. Y. Univ.). July 25, 1963. Contract AT(30-1)-875. 42p.

The capture of negative pions from rest by light nuclei, primarily O^{18}, is investigated by means of a shell-model calculation. The conventional pion-nucleon ps-(ps) interaction is used to calculate the probability of one-nucleon and two-nucleon ejection from the nucleus. Due to the effects of distorted waves, one-nucleon ejection is not found to be suppressed as has been previously supposed but is comparable to the two-nucleon mode. It is also found that back-to-back ejection of a nucleon pair is dominant over parallel ejection and that the capture probability as a function of the angle between an ejected pair will show structure. Some formal problems of the theory are discussed in an appendix. (auth)

34735 (PAEC(D)PH635) A STUDY OF THE APPLICATIONS OF COMPTON BACKSCATTER RADIATION. Q. O. Navarro, A. Castro, A. G. Garcia, and J. C. Comiso (Philippines. Atomic Energy Commission. Atomic Research Center, Manila). June 1963. 18p.

The effects of scattering angle, source angle, source position, detector position, and gamma-ray energy on the intensity of backscatter radiation from Al, asbestos, glass, steel, plywood and G.I. sheets of various thicknesses were

studied using the 662-kev gamma ray of Cs^{137} as the radiation source. Intensity showed a minimum between 80 and 90° scattering angles, varied little with the source angle, and was proportional to the material density and thickness. The signal-to-background ratio increased as the source was brought nearer the scatterer or the detector was moved away from the scatterer. The 362-kev gamma was quite satisfactory for steel and Fe measurements; less so for thickness determination of Al, asbestos, and glass. (D.C.W.)

34736 (PPAD-487F) MEASUREMENT OF THE ANOMALOUS GYROMAGNETIC RATIO OF THE POSITIVE MU MESON (thesis). George R. Henry (Princeton–Pennsylvania Accelerator, Princeton, N. J.). May 1963. Contract AT(30-1)-2137. 111p.

A technique was developed for trapping charged particles in a pure, nearly homogeneous (±1%), 28 kgauss magnetic field for long times (≈15 μ sec). One particle at a time is trapped, the trapping mechanism being triggered by the arrival and detection of the particle. This technique was used to trap μ^+ mesons, and by observing the difference between the spin precession frequency and cyclotron frequency, (g-2) for the μ^+ is measured. The value obtained in the first (g-2) run is: $(g/2 - 1) = 0.00106 \pm 0.000067$. This is to be compared with the theoretical value of 0.0011654 and with the CERN (g-2) measurement using different techniques of 0.001162 ± 0.000005. 37 references. (auth)

34737 (TID-19142) DOUBLE-PHASE REPRESENTATION OF ANALYTIC FUNCTIONS. Masao Sugaware (Purdue Univ., Lafayette, Ind.) and Yoichiro Nambu (Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies and Chicago. Univ.). [1963]. Contract [AT(11-1)-264]. 35p.

The double phase representation for the elastic scattering amplitude A(s,t,u) as a function of the covariant Mandelstam variables s, t, and u is discussed. Conditions for the existence of the double representation, and their implications, are examined. The asymptotic forms of this double phase representation when some of s, t, and u become infinite are derived in the case when the phase approaches the limit at infinity not too slowly. This is the case when the elastic scattering amplitude exhibits asymptotically a power behavior in energy (usually called the Regge behavior). In particular, the case when the forward peak of high-energy elastic scattering does not shrink is examined closely. No-shrinkage is found to be the case when the phase in the crossed channel does not diverge logarithmically at infinity in its momentum-transfer plane. If the forward peak shrinks, the above phase diverges logarithmically at infinity. In the case of no-shrinkage, the asymptotic shape of the forward peak is determined solely by the phase in the crossed channel. Furthermore, the above shape assumes a pure exponential function of the covariant momentum-transfer squared when momentum-transfer is small, and approaches a power behavior in the same variable for large momentum-transfer. Some of the specific predictions of the phase representation approach to high-energy elastic scattering are listed. (auth)

34738 (UCRL-10779) K^--PROTON INTERACTIONS NEAR 760 Mev/c (thesis). Pierre L. Bastien (California. Univ., Berkeley. Lawrence Radiation Lab.). Feb. 1963. Contract W-7405-eng-48. 77p.

The interactions of K^- mesons with hydrogen, at beam momenta of 620, 760, and 850 Mev/c, were studied in the 15-inch hydrogen bubble chamber. The cross sections for all the reactions allowed at these momenta were measured, together with the angular distributions for the two-body final states. The energy dependence of these cross sections shows that, at 760 Mev/c, they are affected by a recently discovered resonant state, Y_1^* (1660). On the basis of an analysis of the cross sections, a spin assignment of $\frac{1}{2}$ for Y_1^* (1660) is ruled out. A spin assignment of $\frac{3}{2}$ seems to be more consistent with the data than higher spin values because of the absence of large $\cos^3\theta$ terms in the angular distributions at 760 Mev/c. (auth)

34739 (UCRL-10838) STRANGE-PARTICLE PRODUCTION BY 1170-Mev/c π^- MESONS IN HYDROGEN (thesis). Jared Arnold Anderson (California. Univ., Berkeley. Lawrence Radiation Lab.). May 27, 1963. Contract W-7405-eng-48. 40p.

Production of $\Lambda + K^0$, $\Sigma^0 + K^0$, and $\Sigma^- + K^+$ by 1170-Mev/c π^- mesons was studied in a 72-inch hydrogen bubble chamber. Cross sections, angular distributions, and polarizations are presented. The polarization of the Σ^0 is determined at four center-of-mass angles and found to be small everywhere. Based on published results for the reaction $\pi^+ + p \rightarrow \Sigma^+ + K^+$, a comparison of the polarizations of Σ^+, Σ^-, and Σ^0 is made from the charge-independence triangle. A conclusion is reached that the Σ^- polarization should be large and that the Σ^- and Σ^+ polarizations should be opposite in sign. (auth)

34740 SCATTERING THEORY AND ADIABATIC SWITCHING. Kurt Haller (New York Univ., New York). Am. J. Phys., 31: 614-17(Aug. 1963).

An elementary procedure for deriving the Born series for the transition amplitude for elastic scattering is developed. It is shown that the use of adiabatic switching eliminates the difficulties of energy nonconserving transitions and ambiguously defined improper integrals, which are usual in elementary treatments. (auth)

34741 BACKSCATTERING OF ELECTRONS FROM URANIUM. Shigeru Okabe, Tatsuo Tabata, Rinsuke Ito, and Kyue Fukuda. Ann. Rept. Radiation Center Osaka Prefect., 3: 64(1962). (In English)

The ratio of backscattered electrons to primary electrons incident on a thick U target was measured with slightly divergent beams in the energy range 4.7 to 11.3 Mev. The backscattering ratio was found to decrease from 30% at 4.7 Mev to 18% at 11.3 Mev. (P.C.H.)

34742 REDUNDANT ZEROS AND POLES ON THE UNPHYSICAL SHEET IN A MODEL OF FIELD THEORY. Z. Bialynicka-Birula (Inst. of Physics, Polish Academy of Sciences). Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 11: 301-4(1963). (In English)

The scattering with the unstable intermediate state is investigated in a model with fixed fermions. It is shown that there exists a definite relation between the number of zeros of the scattering amplitude and the number of poles on unphysical sheet. (auth)

34743 A CONVENIENT REPRESENTATION FOR ANGULAR MOMENTUM WAVE FUNCTION OF THREE PION SYSTEM. R. Raczka. Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 11: 305-8(1963). (In English)

An angular momentum eigenfunction for the three pion system that depends on coordinates and energies of the individual particles is presented. The direct product of three one-particle state vectors in the momentum representation is used in the derivation. (C.E.S.)

34744 THE SOLUTION OF THE FEYNMAN-GELL-MANN EQUATION IN THE SPINOR SPACE. THE FINITE DIMENSIONAL REPRESENTATIONS OF THE LORENTZ GROUP. J. Mozrzymas (Inst. of Physics, Polish Academy

of Sciences, Wroclaw). Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 11: 309-15(1963). (In English)

The relativistic spherical functions for the finite dimensional and unitary representations of the Lorentz group are used to derive the solution of the Feynman-Gell-Mann equation in spinor space. A four-dimensional spin-orbit coupling operator and its relation to the Lorentz group irreducible representations are discussed. (C.E.S.)

34745 NEUTRINO GAS STATISTICS. B. Kuchowicz. Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 11: 317-22(1963). (In English)

Statistical formulas for a non-interacting neutrino gas are presented. Analytic expressions for the dimensionless chemical potential and simple equations of state are derived. Dependence of neutrino density on temperature for different values of the chemical potential is shown. (C.E.S.)

34746 THE EFFECT OF A PION PRODUCTION ON THE LOW ENERGY PION-NUCLEON SCATTERING. A. Deloff. Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 11: 323-6(1963). (In English)

The meson (π) production cross section in meson (π)-nucleon scattering above the 170-Mev threshold is investigated to determine the effect of the meson (π) production process. (C.E.S.)

34747 ON INFLUENCE OF THE N*-STATE ON THE NUCLEON POLARIZATION IN PION-NUCLEON SCATTERING. T. Zieliński (Univ. of Warsaw). Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 11: 333-5(1963). (In English)

The meson (π)-nucleon scattering process is considered in the ($\frac{3}{2}$, $\frac{3}{2}$)-resonance energy region. It is shown that the assumption of ordinary $\frac{3}{2}$-waves domination on one hand and assumption of isobar creation on the other, lead to different polarizations of the final nucleons. (C.E.S.)

34748 DESCRIPTION OF POLARIZATION OF ARBITRARY SPIN PARTICLES BY ONE SCALAR FUNCTION. T. Zielinski (Univ. of Warsaw). Bull. Acad. Polon. Sci., Ser. Sci., Math., Astron. Phys., 11: 337-9(1963). (In English)

A real scalar function is used to describe the polarization of a beam of particles of arbitrary spin. A one-to-one correspondence between the polarization of a particle and certain two-dimensional surfaces is established to make possible a geometrical interpretation of various polarization states. (C.E.S.)

34749 THE SCATTERING OF ELECTRONS AT LOW ENERGIES. Henri Van Regemorter (Observatoire de Paris). Compt. Rend., 257: 63-6(July 1, 1963). (In French)

The theory of broadening factors of spectral rays due to Lindholm is equivalent to the utilization of the semiclassical method of the impact parameter in the case of elastic scattering when the dephasing of partially scattered waves is caused by the polarization potential of the atom. It is shown that the elastic cross sections thus calculated differ only slightly from experimental results when the scattering agent is hydrogen or sodium in the ground state. (tr-auth)

34750 ELECTRON-PAIR INTERPRETATION OF THE PION INTERACTION AND THE STRUCTURE OF HEAVY MESONS. Current Sci. (India), 32: 61(Feb. 1963). (In English)

34751 A CLASS OF SCATTERING AMPLITUDES WHICH SATISFY THE UNITARITY CONDITION. M. Petráš (Univ. of Komenskeho, Bratislava). Czech. J. Phys., 13: 477-81(1963). (In English)

The unitarity condition is applied to the Regge representation of the scattering amplitude. This leads to a linear inhomogeneous algebraic equation for the residua of Regge poles and to a linear inhomogeneous integral equation (with Cauchy kernel) for the conical amplitude that can be solved exactly. (auth)

34752 THE ABSORPTION OF GAMMA ENERGY IN MACROSYSTEMS. A. Kh. Breger, V. A. El'tekov, B. M. Terent'ev, B. I. Vainshtein, N. P. Syrkus, N. A. Krasnoshchekova, V. B. Osipov, and V. A. Gol'din (Karpov Inst. of Physical Chemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 150: 866-9(June 1, 1963). (In Russian)

A Monte Carlo method was used to calculate the absorbed gamma dose, the fraction of useful gamma energy available, and the build-up factor for large gamma sources having the configuration of a "tubular heat-exchanger" with the gamma activity inside the hollow tubes of the bundle, and of a "hollow tube" irradiator with a series of small cylindrical sources placed around a large hollow tube. The absorption of gamma energy in the source η_s, in neighboring sources η_0, and in the equipment η_e were calculated separately by the Monte Carlo method for 1.25-Mev γ rays. The total absorbed dose was also determined experimentally for the model by ferrous sulfate dosimetry. The calculated values agreed well with the experimentally determined values. Hence, it was concluded that the Monte Carlo method can be used to determine the optimum design of large gamma irradiators. (TTT)

34753 THE RANGE OF 6.50-Mev PROTONS IN AGFA K2 EMULSIONS. Irene Hauser (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Exptl. Tech. Physik, 11: 126-9 (1963). (In German)

The range of protons with an energy of 6.50 Mev was determined as 273.6 ± 7.6 μ in the Agfa K2 emulsion. The density of the emulsions was 3.58 g/cm^3 at a relative humidity of 60%. The deviation of the measured values from the energy-range curve of Bebel corresponds to the variations of the composition and the density. (tr-auth)

34754 RESONANT STATES. Robert Gouiran (CERN, Geneva). Ind. At., 7: No. 5-6, 66-72(1963). (In French)

As a complement to the list of elementary particles, a list of resonant states is proposed as a sort of pseudoparticle with very short life. The principles of resonant phenomena in mechanics and in nuclear physics are summarized. The isobar N* and the dipion ρ are given as examples. It is shown how resonances are discovered, and a list of resonances is given. (tr-auth)

34755 BREMSSTRAHLUNG EMISSION OF SOFT QUANTA. CALCULATION IN SECOND BORN APPROXIMATION. A. D. Gazazyan, E. V. Sekhposyan, and M. L. Ter-Mikaelyan (Inst. of Physics, Erivan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz. Mat. Nauk, 16: 69-78(1963). (In Russian)

Simple closed formulas were developed for differential and integral cross sections of soft bremsstrahlung. The effects of dielectric properties of the medium on emission and polarization are analyzed. (R.V.J.)

34756 ON THE CHERENKOV RADIATION IN A WAVEGUIDE. E. D. Gazazyan and E. M. Laziev (Inst. of Physics, Erivan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz. Mat. Nauk, 16: 79-85(1963). (In Russian)

Previously it was shown that the Cherenkov emission spectrum is discreet and is a function of a waveguide parameter. Analyses of a point charge in a charged finite-length filament and in a series of filaments showed that in the case of charged filaments not all frequencies

emit from the point charge and that a certain correlation exists between the radius of the waveguide and the length of the filament. It is also shown that a certain interference takes place in the case of filaments stacked one behind the other. (R.V.J.)

34757 STIMULATED COMPTON SCATTERING OF ELECTRONS BY STANDING WAVES OF LIGHT. A. C. Hall (Socony Mobil Oil Co., Inc., Dallas). Nature, 199: 683(Aug. 17, 1963).

The possibility of using laser beams for the stimulated Compton scattering of electrons by standing waves of light is discussed. Previous attempts to investigate the interaction between electrons and photons are also described. (C.E.S.)

34758 THE EXISTENCE OF TWO TYPES OF NEUTRINOS. G. Luеders and W. D. Schmidt-Ott (Universität, Gottingen, Ger.). Naturwissenschaften, 50: 463-6(1963). (In German)

The postulations and experimental verification of the existence of the neutrino are briefly reviewed. The different types of charge quantum numbers that led to the hypothesis of two types of neutrinos are discussed. The Columbia University experiment to detect the existence of two types of neutrinos is described, and the results are discussed. The results indicate that electron and muon neutrinos are different from each other. (J.S.R.)

34759 DOSE FIELDS FROM PLANE SOURCES USING POINT-SOURCE DATA. J. H. Hubbell (National Bureau of Standards, Washington, D. C.). Nucleonics, 21: No. 8, 144-8(Aug. 1963).

Analytic point-source buildup-factor equations that lead to analytic solutions for a variety of distributed source problems with rotational symmetry about a source-detector axis are summarized. Extension of these formulas to include other distributed source problems by expanding the point-source buildup factor as a power series is illustrated by calculating dose rates from a disk and a rectangular source. (auth)

34760 ABSORPTION AND TRANSFORMATION OF POWERFUL RADIATION FLUXES. I. DENSITY MATRIX EQUATIONS AND THEIR APPLICATION TO AN IRRADIATION OF THE MATERIAL WITH MONOCHROMATIC RADIATION. P. A. Apanasevich. Opt. Spectry. (USSR) (English Transl.), 14: 325-30(May 1963).

Equations for the density matrix were obtained which describe the behavior of a molecule interacting with a quantized radiation field in the presence of a surrounding medium. The influence of the surrounding medium on the system under consideration is in these equations accounted for by means of probabilities for nonoptical transitions and for shifts of levels in the molecule. The obtained equations are applied to a calculation of the interaction of monochromatic radiation with systems of two or three levels. As a result formulas were obtained describing absorption and taking saturation into consideration, in which generally introduced relaxation times are expressed in terms of transition probabilities within the molecule. The width and shape of the natural emission and scattering lines were investigated as a function of the power of incident radiation. It is shown that these lines draw together in their spectral properties with increasing power of radiation. (auth)

34761 γ_5 INVARIANCE. K. Johnson (Massachusetts Inst. of Tech., Cambridge). Phys. Letters, 5: 253-4 (July 15, 1963). (In English)

It was long argued with the use of formal γ_5 invariance that a Lagrangian that contains no bare mass for Fermi particles implies that no mass can be generated by an interaction which "possesses" the symmetry, if the vacuum possesses the symmetry. If the vacuum does not possess the symmetry, then other objectionable features arise (zero mass pseudoscalar states). It was shown recently that another exception can occur if the fermion mass operator has certain anomalies in its spectrum. However, the symmetry is still present in that two Fermi particles appear (with masses $\pm m$). This would then mean that the zero mass pseudoscalar particles could be avoided but only with the cost of a doublet of fermions with opposite parities. A mathematical solution is offered. (R.E.U.)

34762 ON THE VALIDITY OF THE $|\Delta I| = \frac{1}{2}$ SELECTION RULE IN Σ DECAY. P. Franzini and D. Zanello (Istituto Nazionale di Fisica Nucleare; Universita; and Scuola Normale Superiore, Pisa, Italy). Phys. Letters, 5: 254-5(July 15, 1963). (In English)

The validity of $|\Delta I| = \frac{1}{2}$ selection rule was recently questioned in the case of Σ decay into pions and nucleons on the basis of new experimental data. Having re-examined the experimental situation for the processes $\Sigma^- \rightarrow \pi^- + n$, $\Sigma^+ \rightarrow \pi^+ + n$, $\Sigma^+ \rightarrow \pi^0 + p$, in a more consistent and complete way, it is concluded that the data are not in disagreement with the validity of the $|\Delta I| = \frac{1}{2}$ rule. (R.E.U.)

34763 Ξ^- PROPERTIES. L. Jauneau (Ecole Polytechnique, Paris), D. Morellet, U. Nguyen-Khac, et al. Phys. Letters, 5: 261-5(July 15, 1963). (In English)

The mass, lifetime, and α parameter of the Ξ^- was measured on a sample of 320 Ξ^- events produced in a heavy liquid bubble chamber by a beam of 1.45 ± 0.03 Bev/c. The liquid used was freon 115, and the magnetic field of the chamber was 1.7 W/m^2. Leptonic decays, charge exchange events, and inelastic interactions were also observed and reported. (R.E.U.)

34764 ON THE POSSIBILITY OF EXPERIMENTS WITH NATURAL NEUTRINOS DEEP UNDERGROUND. M. G. K. Menon (Tata Inst. of Fundamental Research, Bombay), P. V. Ramana Murthy, B. V. Sreekantan, and S. Miyake. Phys. Letters, 5: 272-4(July 15, 1963). (In English)

Measurements on the cosmic-ray muon intensity at very large depths underground (up to a maximum depth of 8400 mwe) were recently carried out in the Kolar Gold Fields (Mysore State, India). The penetrating component deep underground consists primarily of "atmospheric" muons which arise from the decay of pions and kaons produced by cosmic rays in the atmosphere. Experiments were carried out involving natural neutrinos deep underground using parallel detector layers in coincidence mounted vertically and with exposures of the order of 10^4 m^2-days. (R.E.U.)

34765 ON THE NON-SHRINKING π-p DIFFRACTION PEAK NEAR 10 Gev. C. H. Chan (Middle East Technical Univ., Ankara). Phys. Letters, 5: 274-6(July 15, 1963). (In English)

Recent experiments on π^+p elastic scattering in the energy range 3 to 17 Bev/c show that the width of the diffraction peak is constant in contrast to the strongly decreasing width of the p-p peak. This result is in contradiction with the simple prediction from the Regge pole expansion, that high-energy elastic scattering is entirely controlled by the Pomeranchuk pole in the crossed channel and hence all diffraction peaks should shrink as the logarithm of the total center of mass energy squared. It is concluded that even taking the nucleon spin in the πN scattering into account but making the assumption that the only singularities are moving poles in the complex j-plane, the theory cannot account

for both a nonshrinking π^-p peak and a shrinking p-p peak. (R.E.U.)

34766 A Kπ RESONANT STATE AT 726 Mev. D. H. Miller, G. Alexander, O. I. Dahl, L. Jacobs, G. R. Kalbfleisch, and G. A. Smith (Univ. of California, Berkeley). Phys. Letters, 5: 279-82(July 15, 1963). (UCRL-10797 (Rev.)) (In English)

The existence of an unstable meson with strangeness S = +1, mass 726 ± 3 Mev, and full width $\Gamma \lesssim 20$ Mev appears reasonably established from a study of the Kπ effective-mass distributions observed in π^- + p interactions. The simplest interpretation of these data suggests the isotopic-spin assignment I = ½. No unambiguous evidence for a determination of the spin and parity was obtained. (R.E.U.)

34767 PRODUCTION OF THE KAPPA MESON IN K^--p INTERACTIONS. S. G. Wojcicki, G. R. Kalbfleisch, and Margaret H. Alston (Univ. of California, Berkeley). Phys. Letters, 5: 283-6(July 15, 1963). (UCRL-10761(Rev.); UCRL-10761) (In English)

Evidence was given for the existence of an excited state in the Kπ system at ~725 Mev from recent work on π^-p interactions. Some theoretical implications of this excited state (κ meson) are considered. A systematic analysis of the reaction $K^- + p \rightarrow \bar{K}^0 + \pi^- + p$ was undertaken to search for this κ meson effect in K^-p interactions. (R.E.U.)

34768 SOME REMARKS ABOUT A SECOND POMERANCHUK TRAJECTORY. V. I. Lendyel and J. Mathews (California Inst. of Tech., Pasadena). Phys. Letters, 5: 286-8(July 15, 1963). (In English)

The possibility of a second Pomeranchuk trajectory was pointed out. The assumption of no trajectory $\alpha(t)$ with $\alpha(0) > 0$ except the Pomeranchuk trajectory ($\alpha_p(0) = 1$) leads to a sum rule for the nonisotopic-spin-flip scattering length which disagrees seriously with the experimental value. It was further observed that by including a second vacuum trajectory $\alpha_{p'}(t)$, with $\alpha_{p'}(0) \approx 0.5$, the correct scattering length can be obtained. (R.E.U.)

34769 RENORMALIZATION GROUP AND REGGE BEHAVIOUR. S. Deser, G. Furlan, and G. Mahoux (CERN, Geneva). Phys. Letters, 5: 333-5(Aug. 1, 1963). (In English)

The validity of the renormalization group equations used to obtain Regge pole behavior is discussed. It is shown that the renormalization group equations contain a certain amount of arbitrariness when a perturbation theory amplitude is used as input. (C.E.S.)

34770 τ, τ' AND $\eta \rightarrow 3\pi$ DECAYS AND UNITARY SYMMETRY. S. Hori, S. Oneda, S. Chiba, and A. Wakasa (Kanazawa Univ., Japan). Phys. Letters, 5: 339-41(Aug. 1, 1963). (In English)

An argument is advanced that indicates that the pion pole model may not work in describing the particular cases of τ, τ', and η decays. The effects of the P and S-wave interactions in the boson pole approximation and unitary symmetry theory are considered, and the π-π final state interactions that seem to be less important are neglected for the sake of simplicity. (C.E.S.)

34771 THE REAL PARTS OF THE HIGH ENERGY $\pi^\pm$ p FORWARD-SCATTERING AMPLITUDES. P. G. O. Freund (Univ. of Chicago). Phys. Letters, 5: 341-3(Aug. 1, 1963). (In English)

On the basis of the well-established forward π-N scattering dispersion relations it is shown that unless the π^+ p energy dependent total cross sections approach smoothly very small values ($\lesssim$ 7mb) or zero for increasing energy the real parts of the high-energy forward scattering amplitude becomes very small ($\lesssim 0.05$) for energies above 10 Bev/c. (C.E.S.)

34772 SHRINKING AND NON-SHRINKING DIFFRACTION PEAKS. P. G. O. Freund and R. Oehme (Univ. of Chicago). Phys. Letters, 5: 353-5(Aug. 1, 1963). (EFINS-63-47). (In English)

Important theoretical differences between the high-energy limits of the amplitudes for proton-proton scattering and proton-antiproton scattering are outlined. These differences are discussed in connection with the asymptotic forms of $\pi^\pm$-p scattering. All reactions are considered within the framework of dispersion theory in which the high-energy limits are determined by the singularities in the complex angular momentum planes of the crossed reactions $p\bar{p} \rightarrow p\bar{p}$ and $\pi^+\pi^- \rightarrow p\bar{p}$, respectively. It is shown that a non-shrinking diffraction peak should be expected in connection with a total cross section that is slowly decreasing toward a constant value, whereas a shrinking peak is associated with an essentially constant total cross section. (C.E.S.)

34773 ELEMENTARITY OF VECTOR MESONS. Kunio Yamamoto (Univ. of Chicago). Phys. Letters, 5: 355-6 (Aug. 1, 1963). (EFINS-63-42). (In English)

It is shown that vector mesons cannot be described by elementary poles except in the unrealistic case for which the total cross section increases as the log of the square of the center-of-mass energy for large energies. A method for determining whether the assumed asymptotic behavior of the scattering amplitude is consistent with the unitarity condition is presented. (C.E.S.)

34774 ON THE DISTRIBUTION OF TRANSVERSE MOMENTA AND ITS CONNECTION WITH ELASTIC SCATTERING AT HIGH ENERGIES. D. S. Narayan and K. V. L. Sarma (Tata Inst. of Fundamental Research, Bombay). Phys. Letters, 5: 365-8(Aug. 1, 1963). (In English)

Assuming that the scattering amplitude in the forward direction is pure imaginary and the distribution of transverse momenta of the scattered particles is independent of incident energy, a simple relation between the elastic cross section, the total cross section, and average transverse momenta that is valid at all high energies is obtained. This relation is in agreement with results on p-p and π-p scattering. The differential scattering cross section, obtained on the basis of these assumptions, shows an initial shrinkage of the diffraction peak with energy up to a few Bev, but with further increase of energy the rate of shrinkage drops, and finally the width of the diffraction peak becomes independent of energy. (C.E.S.)

34775 ELASTIC SCATTERING OF 1.2 Bev/c MUONS FROM HYDROGEN. H. F. Davis, T. E. Ewart, G. E. Masek, E. D. Platner, J. P. Toutonghi, and R. W. Williams (Univ. of Washington, Seattle). Phys. Rev., 131: 2192-2202(Sept. 1, 1963).

The absolute cross section for the elastic scattering of negative muons from protons was measured over a range of momentum transfers of 450 to 850 Mev/c. The muon beam was formed by decay in flight of Bevatron produced pions and was separated from the pion beam electronically by using four gas-filled threshold Čerenkov counters. A total of 3×10^8 muons were incident on two large liquid hydrogen targets in tandem and gave a total of 56 ± 9 acceptable scattering events, as compared to 48 predicted by the Rosenbluth formula for electromagnetic scattering from protons. A χ-square analysis of the scattered events gave agreement at the 75% level for the angular distribu-

tion of the data and the theoretical predictions, and gave with 95% confidence $\Lambda^{-1} \leq 0.16$ F, where Λ^{-1} is the conventional breakdown parameter. Hence, in this experiment, the behavior of muons scattered from protons at large momentum transfers is indistinguishable from that of electrons. (auth)

34776 RADIATIVE CORRECTIONS TO CHARGED PION DECAYS MEDIATED BY VECTOR BOSONS. R. A. Shaffer (Vanderbilt Univ., Nashville). Phys. Rev., 131: 2203-5(Sept. 1, 1963).

The lowest order electromagnetic corrections to the ratio $\Gamma(\pi \rightarrow e + \nu)/\Gamma(\pi \rightarrow \mu + \nu')$ have been calculated in an intermediate vector boson theory. The results indicate that the ratio is relatively insensitive to the value of the boson's mass. The ratio agrees with the experimentally determined value. (auth)

34777 IMPROVED DETERMINATION OF THE NEUTRAL DECAY BRANCHING RATIOS OF THE K_1^0 MESON AND THE Λ^0 HYPERON. M. Chretien (Brandeis Univ., Waltham, Mass.), V. K. Fischer, H. R. Crouch, Jr., et al. Phys. Rev., 131: 2208-18(Sept. 1, 1963). (TID-18692)

Neutral branching ratios of the K_1^0 meson and the Λ^0 hyperon were measured, using a 15-in. bubble chamber filled with methyl iodide, propane, and ethane. The neutral modes of the decays were observed directly from the materialized γ rays. The results are $B_K = 0.288 \pm 0.021$ and $B_\Lambda = 0.291 \pm 0.034$. The B_K ratio suggests an admixture of $|\Delta I| = 3/2$ in the K_1^0 decay consistent with that implied by the decay $K^+ \rightarrow \pi^+ + \pi^0$. The relative phase φ between the $|\Delta I| = 1/2$ and $3/2$ amplitudes is determined to be $\varphi = 0^{+54}_{-6}$ degrees. (auth)

34778 APPLICATION OF GENERALIZED FIELD THEORY TO BARYONS. H. C. Corben (Space Tech. Labs., Inc., Redondo Beach, Calif.). Phys. Rev., 131: 2219-25 (Sept. 1, 1963).

The simplest relativistic wave equations for a particle, which in the classical limit possesses moments of inertia about more than one axis, are Dirac and Kemmer–Duffin equations containing extra terms which cause these equations to describe a variety of spin states. The classical field theory of such wave equations is developed and the generalized Dirac equation for particles of spin $1/2$ and $3/2$ is examined in detail. It is found that with the choice of two parameters, one of which merely determines the scale, this equation not only correctly describes the spin and charge states of the particles and resonances Ξ^-, Ξ^0, n, p, N^{**}, N^{**0}; it also yields their masses correct to better than 2%. The $\Xi^- - \Xi^0$ and n–p mass differences have the correct sign but are several times their observed values. Choice of one other parameter to give the correct n–p mass difference would lead to even better agreement with experiment for the other states, but would also lead to proton and neutron isobars lying 20 Mev above the ground state. (auth)

34779 ASYMPTOTIC BEHAVIOR OF NUCLEON–NUCLEON SCATTERING. David H. Sharp and William G. Wagner (California Inst. of Tech., Pasadena). Phys. Rev., 131: 2226-38(Sept. 1, 1963).

A detailed analysis of NN and $N\overline{N}$ scattering on the basis of the Regge hypothesis is carried out. The Regge expansions of a set of ten invariant amplitudes describing NN scattering are presented, with residues expressed in factorized form. Expressions involving both the full Legendre functions and their asymptotic forms are given. Spin sums are carried out to obtain simple and convenient expressions for the contributions of the P, ρ, ω, and P′ trajectories to the differential cross sections. The optical theorem has been applied to find the contribution of the P, P′, ρ, and ω trajectories to the spin-averaged total cross sections. Finally, the available data on the total and differential cross sections for NN scattering was analyzed to extract information about the Regge-pole parameters. The possible effect of the spin structure of the amplitudes, and the variation with energy of the Legendre functions was taken into account. Shown, by a natural definition of helicity flip and no-flip couplings, is that the amplitudes, and especially the cross sections, for NN scattering are very simple in the asymptotic limit. In an Appendix, the decay properties of a spin-2 meson associated with the Pomeranchuk Regge pole are discussed. (auth)

34780 BARYON–BARYON INTERACTIONS AND THE EIGHTFOLD WAY. R. J. Oakes (Stanford Univ., Calif.). Phys. Rev., 131: 2239-41(Sept. 1, 1963).

The deuteron is shown to belong to a ten-dimensional irreducible representation of the group SU(3) in the symmetry scheme called the eightfold way. The baryon-baryon states, which together with the deuteron comprise this supermultiplet, are studied. Data are discussed which favor the existence of some of these states, and the masses of the remaining states are estimated. (auth)

34781 ANALYSIS OF Y_1^* (1520) AND DETERMINATION OF THE Σ PARITY. Mason B. Watson, Massimilliano Ferro-Luzzi, and Robert D. Tripp (Univ. of California, Berkeley). Phys. Rev., 131: 2248-81(Sept. 1, 1963). (UCRL-10542)

The interaction of K^- mesons on protons resulting in elastic and charge-exchange scattering and hyperon production are reported for a range of momenta from 250 to 513 Mev/c. About 10,000 events obtained in the Lawrence Radiation Laboratory's 15-in. bubble chamber were analyzed. Differential and total cross sections for all channels are examined. For $\Sigma^+\pi^-$, $\Sigma^0\pi^0$, and $\Lambda\pi^0$ production, polarization measurements are also available. A resonant state is identified with a mass 1519 Mev and a full width Γ = 16 Mev, decaying into $\overline{K}N$, $\Sigma\pi$, and $\Lambda\pi\pi$ in the branching ratio 30 : 55 : 15, respectively. The resonance is found to have isotopic spin 0 and spin $3/2$, and its parity is that of the $\overline{K}N$ D_{3_3} state. By use of the polarization arising from the D_{3_3}–S-wave interference, a strong argument for negative $KN\Sigma$ parity is obtained. All the data are fitted to a model based on a Breit-Wigner resonant amplitude and nonresonant S, P, and D amplitudes parametrized by constant scattering lengths. An extensive search for χ^2 minima was done on an IBM 7090 computer under various assumptions for the spin and parity of the resonance. Only the D_{3_3} possibility in both K^-p and $\Sigma\pi$ states yields a satisfactory (43% probability) fit. A D_{3_3} K^-p resonance (with $\Sigma\pi$ in F_{3_3}) is the nearest alternative possibility, with a likelihood of less than 1% of fitting the data. (auth)

34782 HIGH-ENERGY QUASIELASTIC PROTON–PROTON SCATTERING AND FINAL-STATE INTERACTION. M. M. Islam (Brown Univ., Providence). Phys. Rev., 131: 2292-2304(Sept. 1, 1963).

The explanation by Drell and Hiida of the inelastic bump, observed by Cocconi et al., in high-energy proton-proton scattering is shown to be inadequate for two reasons: (i) The $g(t) \equiv [d\sigma(s_1,t)/d\Omega]/[d\sigma(s_1,0)/d\Omega]$ chosen by Drell and Hiida gives too large wide-angle πN scattering, while a calculation consistent with wide-angle πN scattering gives a differential cross section smaller by a factor of five than the experimental cross section; (ii) the primary process in the Drell-Hiida mechanism gives much too small D-

and F-wave amplitudes, so that even strong resonant final-state interactions in these states do not give any appreciable structure to the differential cross section. A formulation for the final-state interaction between the pion and the recoil nucleon is given, and it is shown that the nonresonant final-state scattering in S and P waves gives large enhancement. (auth)

34783 BOOTSTRAPS AND THE PION–NUCLEON SYSTEM. Ernest Abers and Charles Zemach (Univ. of California, Berkeley). Phys. Rev., 131: 2305-18(Sept. 1, 1963).

It was suggested that all the observable properties of strongly interacting systems can be determined self-consistently if there do not exist any elementary particles in the conventional sense. This conjecture is applied to the nucleon mass and the pion-nucleon coupling constant, which are calculated under the assumption that the nucleon is composite, and that its existence is a consequence of the same forces which produce pion-nucleon resonances. A self-consistent calculation is possible because the nucleon and the $P_{3/2\ 3/2}$ resonance are principally responsible for the forces which produce each other, providing an example of a "boot-strap" or self-supporting mechanism. The N/D method is used for computations. Some ambiguity in the quantitative results due to high-energy processes is unavoidable, but calculations with a large range of "cutoff" values predict the same orders of magnitude as are observed experimentally. It is shown qualitatively that the self-consistent method not only predicts the nucleon and the $P_{3/2\ 3/2}$ resonance, but excludes other combinations which are not observed. This notion is illustrated by consideration of hypothetical interactions between nucleons and scalar mesons and between Λ and Σ hyperons of negative relative parity. (auth)

34784 DYADIC GREEN'S FUNCTION FOR A RADIALLY INHOMOGENEOUS SPHERICAL MEDIUM. C. Yeh (Univ. of Southern California, Los Angeles). Phys. Rev., 131: 2350-3(Sept. 1, 1963).

The general expression for the dyadic Green's function is obtained. It is then applied to the problem of radiation from an electric dipole in a radially inhomogeneous dielectric medium. Possible applications to electromagnetic scattering problems and to elementary particle scattering problems are noted. (auth)

34785 BROKEN SYMMETRIES AND MASSLESS PARTICLES. Sidney A. Bludman and Abraham Klein (Univ. of Pennsylvania, Philadelphia). Phys. Rev., 131: 2364-72 (Sept. 1, 1963).

The following generalization of a theorem conjectured by Goldstone is proven: In a theory admitting a continuous group of transformations, suppose a set of operators $\phi_i(x)$, transforming under an irreducible representation of the group, has the property that in the vacuum some expectation values $\langle\phi_{i'}(x)\rangle \neq 0$ for $i = i'$. The theorem then asserts that $\tilde{D}_{ij}(p)$, the Fourier transform of the propagator of $\phi_i(x)$, is singular at $p^2 = 0$ for some $i \neq i'$. (The maximum number of $\{\phi_i\} \neq 0$ is a property of the group representation. The further identification of the singularities as poles and their interpretation as massless particles depends on the usual apparatus of quantum field theory.) The appropriate choice to be made for the field ϕ_i when it describes a boson excitation and when the Lagrangian contains only direct fermion-fermion coupling is discussed. It is suggested that such Fermi interaction theories may be renormalizable when expanded in terms of the coupling between fermions and the collective boson field. The theorem is illustrated by the following models: (A) γ_5 gauge group, where a massless pseudoscalar meson is predicted; (B) isospin group where massless charged mesons are predicted; (C) SU(3) octet model where six or four massless mesons are predicted; (D) Lorentz group where the massless photon is predicted. The limitations of the theorem are also discussed. (auth)

34786 STUDY OF PION-PION RESONANCES IN 3.3-Bev π^--p INTERACTIONS. Zaven G. T. Guiragossian (Univ. of California, Berkeley). Phys. Rev. Letters, 11: 85-8(July 15, 1963).

The interactions $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ and $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ were studied in a 72-in. hydrogen bubble chamber exposed to a (3.3 ± 0.1)-Bev/c π^- beam from the Bevatron. Experimental results include computation of dipion effective mass, invariant momentum transfer to the nucleon, and the angle between the incoming and outgoing π^- in the barycentric system of the final pions. (R.E.U.)

34787 ρ-MESON REGGE TRAJECTORY AND HIGH-ENERGY CHARGE-EXCHANGE SCATTERING. Ivan J. Muzinich (Univ. of Washington, Seattle). Phys. Rev. Letters, 11: 88-90(July 15, 1963).

The n-p charge-exchange differential and total cross sections were recently measured at 2.04 and 2.85 Bev. A very sharp forward peak was reported in the differential cross section. An explanation of this is proposed in terms of the ρ meson treated as a Regge pole. Differences of total cross sections are related to the ρ-meson trajectory at $t = 0$; $\sigma(\pi^+\text{-p}) - \sigma(\pi^-\text{-p})$ and $\sigma(\text{p-p}) - \sigma(\text{n-p})$. (R.E.U.)

34788 VECTOR MESON EXCHANGE MODEL FOR ISOBAR PRODUCTION. Leo Stodolsky and J. J. Sakurai (Univ. of Chicago). Phys. Rev. Letters, 11: 90-3(July 15, 1963). (EFINS-63-30)

Angular momentum and parity are considered in order to make specific predictions of immediate experimental interest based on the vector meson exchange model for isobar production. (R.E.U.)

34789 ISOBAR PRODUCTION BY 910-Mev/c K^+ MESONS. Brandt Kehoe (Univ. of Maryland, College Park). Phys. Rev. Letters, 11: 93-6(July 15, 1963).

The predictions of the vector meson exchange model for isobar production are compared to the results of an experimental investigation of the process $K^+ + p \rightarrow K^0 + p + \pi^+$. (R.E.U.)

34790 ELECTROMAGNETIC AND WEAK INTERACTIONS IN THE UNITARY SYMMETRY SCHEME. S. P. Rosen (Purdue Univ., Lafayette, Ind.). Phys. Rev. Letters, 11: 100-3(July 15, 1963).

In the unitary scheme, particles in a given unitary multiplet are usually classified by isotopic spin and hypercharge. Other classifications are obtained by considering U_2 subgroups of U_3 that are different from isotopic-spin subgroups. These alternative classifications are considered, and general formulas are derived for magnetic moments and electromagnetic mass differences of elementary particles. Some speculations are made about the weak interactions. SU_3 validity is shown by application to baryon-meson resonances of the "tenfold way." (R.E.U.)

34791 ANALYSIS OF PROTON-ALPHA SCATTERING. C. C. Giamati (Lewis Research Center, Cleveland), V. A. Madsen, and R. M. Thaler. Phys. Rev. Letters, 11: 163-5(Aug. 15, 1963).

Using previously reported proton-alpha elastic scattering and polarization data, a complete phase-shift analysis in the energy range 10–40 Mev is presented. The polarization and elastic-scattering data were analyzed by using the Gammel-

Thaler phase shifts as a starting point. The polarization, polarization contour map, and phase-shifts are presented. (C.E.S.)

34792 OBSERVATION OF THE PRODUCTION OF A $\bar{\Xi}^0$ PARTICLE. C. Baltay (Yale Univ., New Haven), J. Sandweiss, H. D. Taft, et al. Phys. Rev. Letters, 11: 165-7(Aug. 15, 1963).

An example of $\bar{\Xi}^0$ production in the reaction $\bar{p} + p \rightarrow \Xi^- + \bar{\Xi}^0 + \pi^+$ is reported. Antiproton reactions in a hydrogen bubble chamber at 3.69 Bev/c were used. (C.E.S.)

34793 SPIN-PARITY DETERMINATION OF THE $\Xi\pi$ RESONANCE (1.530 Gev). P. E. Schlein, D. D. Carmony, G. M. Pjerrou, W. E. Slater, D. H. Stork, and H. K. Ticho (Univ. of California, Los Angeles). Phys. Rev. Letters, 11: 167-71(Aug. 15, 1963).

The $\Xi\pi$ resonance at 1.530 Bev, which was produced by meson (K^-) reactions in a hydrogen bubble chamber at 1.80-1.95 Bev/c, was investigated. A complete angular correlation study of the decay sequence $\Xi^{*0} \rightarrow \Xi^- + \pi^+$, $\Xi^- \rightarrow \Lambda + \pi^-$ is reported. It is concluded that the simplest spin-parity assignment of the resonance is $(^3/_2)^+$. (C.E.S.)

34794 MESON-BARYON RESONANCES AND THE MASS FORMULA. R. J. Oakes and C. N. Yang (Stanford Univ., Calif.). Phys. Rev. Letters, 11: 174-8(Aug. 15, 1963).

The meson-baryon resonances in the octet model are considered. The fact that all the resonances do not have the same mass is supposed to be the result of a symmetry-breaking interaction. To analyze the implications of the symmetry-breaking interactions it is assumed that the meson-baryon resonances correspond to poles in the complex total energy plane of the meson-baryon scattering amplitude that has the appropriate quantum numbers. It is shown that the mass formula, which gives the equal spacing of masses for the 10-dimensional representation, is without theoretical justification. (C.E.S.)

34795 PHYSICS OF WEAK INTERACTIONS AND NEUTRINOS. L. I. Lapidus (Joint Inst. for Nuclear Research, Dubna, USSR). Priroda, No. 6, 5-8(1963). (In Russian)

Physics of weak interactions and available data on neutrino properties in β decay and space are discussed. (R.V.J.)

34796 AN EXACT THEORY OF RELATIVISTIC SCATTERING BY A FIXED POINT SCATTERER. J. L. Martin (National Physical Lab., Teddington, Middx, Eng.). Proc. Roy. Soc. (London), Ser. A, 275: 58-69(Aug. 20, 1963).

The reaction $A \longleftrightarrow A + \mu$ is considered; A is a fixed point scatterer at the origin, and the μ are relativistic scalar particles (mesons) interacting with A only at the origin. Generally, both A and μ are endowed with extra structure, for example, isotopic spin. It is shown that the conventional treatment fails unless the scattering is trivial. An alternative approach is proposed; it is shown that the scattering is almost completely determined by the necessary vanishing of certain scalar products (the orthogonality condition). On the basis of this success, the procedure is reinterpreted in terms of the search for a description of the local interaction as a boundary condition, and it is suggested that this is the most natural way of introducing a local interaction with non-trivial scattering. An important simplification is gained by the use of a relativistic meson field with an indefinite metric; this permits an exact treatment of the problem. Only models with S-wave scattering are considered. (auth)

34797 REGGE POLE HYPOTHESIS AND HIGH ENERGY BEHAVIOR OF THE SINGLE PION PHOTOPRODUCTION. Kiyomi Itabashi (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 29: 724-34(May 1963). (In English)

The high energy behavior of the single pion photoproduction cross section was examined, based on the Regge pole hypothesis. The possibility is pointed out that this reaction would serve for the experimental test of the Regge behavior of, particularly, the photon and ρ-meson. The essential point is that the vacuum trajectory does not give any contribution to this reaction, and accordingly the photon- and the ρ-meson-trajectories dominate the high energy behavior of the forward $\gamma + p \rightarrow p + \pi^0$ and $n + \pi^+$, respectively. (auth)

34798 BOUND STATE PROBLEM AND THE DETERMINATION OF COUPLING CONSTANTS. Hironari Miyazawa and Hirotaka Sugawara (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 29: 735-43(May 1963). (In English)

A formulation is given to obtain the coupling constant of a particle when it is composite. This is done using the condition that the renormalization constant of the wave function vanishes for a composite particle. As an example the pion-nucleon coupling constant is calculated by this method. The value obtained, which depends on the coupling constants of ρ- and ω-mesons to nucleons, is about 35. (auth)

34799 INTERMEDIATE BOSON THEORY OF WEAK INTERACTIONS WITH PARITY CLASH. Shigeru Machida (Rikkyo Univ., Tokyo). Progr. Theoret. Phys. (Kyoto), 29: 744-66(May 1963). (In English)

A systematic theory of weak interactions is presented on the assumption that the primary weak interaction is the one between the intermediate boson and the weak currents. Assuming that the regularities of asymmetry parameters of hyperon nonleptonic decays reflect a certain fundamental law, the doublet spin is considered to be of primary importance. Properties of currents assumed are the following: Vectorpart of the strangeness conserving current is conserved; there exist two kinds of strangeness violating currents, scalar and vector in the doublet spin space respectively, and both of them are of γ_μ-type, i.e., do not include $\gamma_\mu\gamma_5$-type interaction. It is assumed that the primary weak interactions conserve the doublet spin, the K-spin, and the strangeness. Main conclusions of the theory are the following: There exist two sets of intermediate bosons, each set consisting of the particles with +, −, and 0 charges and their antiparticles; intermediate bosons have dual properties, like schizon, concerning the doublet spin, the K-spin, and the strangeness; transitions with $|\Delta S| \geq 2$ do not occur in the first order of weak interactions; isospin selection rule, $|\Delta T| = ^1/_2$, does hold for nonleptonic decays. Asymmetry parameters have the following regularities: $\alpha(\Sigma^+ \rightarrow n + \pi^+) = 0$, $\alpha(\Sigma^- \rightarrow n + \pi^-) = 0$, $\alpha(\Sigma^+ \rightarrow p + \pi^0) = -\alpha(\Lambda \rightarrow p + \pi^-) = \alpha(\Xi^- \rightarrow \Lambda + \pi^-)$; $|\Delta T| = ^1/_2$ does not hold for leptonic decays of hyperons and kaons, and both of processes with $\Delta S = \pm\Delta Q$ occur; matrix elements for $K^0 \rightarrow l^+ + \nu_l + \pi^-$ and for $\bar{K}^0 \rightarrow l^- + \nu_l + \pi^+$ are identical. $K_2^0 \rightarrow l^\pm + \nu_l + \pi^\pm$ and $K^+ \rightarrow l^+ + \nu_l + \pi^0$ occur via corrections to the doublet approximation, and the order of magnitude of the ratios of the decay rates of these processes to that of $K_1^0 \rightarrow l^\pm + \nu_l + \pi^\pm$ are expected to be $\Gamma_2(l^\pm)/\Gamma_1(l^\pm) \sim \Gamma_+(l^+)/\Gamma_1(l^\pm) \sim (m_\Sigma - m_\Lambda)^2/m_\Lambda^2 \sim 1/200$; if we assume the universality of coupling constants of the primary interactions, leptonic decay rates of hyperons become approximately $^1/_8$ for Λ and $^1/_{16}$ for Σ, respectively, of those calculated from the universal V−A four fermion interaction. In this case, $\Sigma^+ \rightarrow n + l^+ + \nu_l$ and $\Sigma^- \rightarrow n + l^- + \nu_l$ occur with the same probability; the Ξ-nucleon parity has to be odd, the parity is conserved in the baryon-baryon scatterings with $\Delta S = 0$ even when the first order weak interactions are included.

An apparent violation or conservation, in the weak interaction processes, of the doublet spin, the K-spin, and the strangeness are regarded in the theory to be the manifestation of the dual natures of the intermediate bosons concerning the corresponding quantities. (auth)

34800 THE EFFECT OF THE COLLECTIVE MOTION OF PION CLOUD ON WEAK INTERACTIONS. Takao Okabayashi (Tokyo Univ.), Ikuko Hamamoto, Akira Hatano, and Toshiko Saikan. Progr. Theoret. Phys. (Kyoto), 29: 767-91(May 1963). (In English)

It is shown that there is a possibility of explaining K^+-decay by the violation of $|\Delta I| = \frac{1}{2}$ rule due to the existence of the $\rho^0-\omega$ mixture, if the doublet image is a good approximation. The effects of the collective motion of the pion cloud with the vector character (ρ and ω) on the $|\Delta I| = \frac{1}{2}$ triangle of Σ decay and the axial-vector coupling constant of β decay are also discussed. It is deduced that the doublet approximation with the chirality consideration is favorable to the problems of Σ and K^+ decay. (auth)

34801 ON THE WEAK INTERACTION OF ELEMENTARY PARTICLES. Sho Tanaka (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 29: 792-4(May 1963). (In English)

A possible model of the weak interactions that explains the existence of the processes $\Sigma^+ \rightarrow n + \mu^+ + \mu^0$ and $K^0 \rightarrow \pi^+ + e^- + \bar{e}_0$ is proposed. The model is based on the intermediate boson theory and the Sakata model and is not restricted to the rigid framework of the current quantum field theory. (C.E.S.)

34802 ANOMALOUS MAGNETIC MOMENTS OF BARYONS IN VIGIER'S ROTATOR MODEL. Hiroshi Katsumori (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 29: 794-6(May 1963). (In English)

Relations for the anomalous magnetic moments of nucleons, hyperons, and mesons based on the Virgin rotator model are derived. The electromagnetic interactions of the particles that are invariant under the interchange of isospin operators J^+ and J^- are used in the derivation. (C.E.S.)

34803 INTERMEDIARY FIELDS BASED ON THE LACK OF THE SELF-CURRENT WEAK INTERACTION. Yasuhisa Katayama, Ken-iti Matumoto, and Kan-ichi Yokoyama (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 29: 796-8(May 1963). (In English)

A concrete model of intermediary fields based on the lack of neutral leptonic current and self-current couplings is presented. It is assumed that all primary weak interactions are realized only by the nonstrange particles but that their coupling fields are different. The lack of all self-current couplings together with the universality of coupling constants requires fields with positive and negative metric in Hilbert space. These requirements yield a simple model that can be interpreted as the intermediary field that causes the strangeness changing weak interactions. (C.E.S.)

34804 NEW APPROACH TO THE STRANGENESS CHANGING WEAK INTERACTION. Yasuhisa Katayama and Ken-iti Matumoto (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 29: 798-9(May 1963). (In English)

The six-body Fermi coupling description of the strangeness changing weak interaction is generalized and results from this approach are analyzed. Several tests of the six-body coupling are also presented. (C.E.S.)

34805 THE ONE BOSON EXCHANGE MODEL IN THE SINGLE PION PRODUCTION PROCESS IN PROTON-PROTON COLLISION. Tamotsu Ueda (Hiroshima Univ.). Progr. Theoret. Phys. (Kyoto), 29: 829-50(June 1963).

The $p + p \rightarrow \pi^+ + p + n$ reaction at 0.97 Bev is studied under the following assumptions: boson and fermion-isobars make contributions; the same quantum field theoretic treatments are applied to them as the usual elementary particles; the reaction is described by the sum of the lowest order matrix elements. As a dominant process the process in which the (3-3) isobar formation occurs with the one pion exchange or other boson exchange is considered. The analysis suggests an existence of an isovector pseudoscalar boson with the mass $3 \sim 4.5\ \mu$. The realistic understanding of the phenomenological pionic form factor is possible in the approach. A consistent interpretation can be made of the previous analysis in terms of the boson exchange model in p-p scattering below ~300 Mev. (auth)

34806 APPLICATION OF REGGE HYPOTHESIS TO MULTIPLE MESON PRODUCTION. Mahiko Suzuki (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 29: 851-64(June 1963).

Inelastic scattering is formulated in terms of Regge hypothesis, provided that the exchanged off-shell Regge particles can be treated like the strongly interacting particles on the mass-shell. The distributions of momentum transfer and some other quantities are calculated within this framework. It is characteristic of this model that $\Delta_{\parallel}^2 - \Delta_0^2$ is small in comparison with $\Delta_{\perp}^2$. Here Δ denotes momentum transfer, and Δ_0, $\Delta_{\parallel}$ and $\Delta_{\perp}$ denote its time, longitudinal, and transverse components, respectively. The formulation is extended to a multicentral description. The so-called H-quantum proposed by S. Hasegawa is conjectured to have the same quantum numbers except for spin. (auth)

34807 APPLICATION OF THE SAWADA TRANSFORMATION TO MULTICHANNEL PROBLEM. Masataka Hosoda (Tokyo Univ.) and Hiroo Shimoida. Progr. Theoret. Phys. (Kyoto), 29: 865-76(June 1963).

The scattering amplitudes for multichannel coupled systems are obtained by generalizing the Sawada transformation in the meson theory. The scattering problem of boson-baryon systems with a total angular momentum of $J = \frac{3}{2}$, a total isospin of $I = 0$, and a strangeness $S = -1$ is considered and is given particular attention to the effects of mass differences among mesons and baryons. Parities of the pion and kaon are assumed to be odd with respect to the ΛN, ΣN, and ΞN. It is shown that mass differences among mesons and baryons give rise to considerable effects for resonance energies. The method turns out to be closely related to the dispersion theoretic approach. (auth)

34808 AN APPROACH TO THE ELEMENTARITY OF PARTICLES. Hiroshi Ezawa, Taizo Muta, and Hiroomi Umezawa (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 29: 877-92(June 1963).

As tools for judging whether a given particle is elementary or composite, a variety of equations, off-shell unitarity conditions, and bound-state equations are presented. The elementarity of deuteron is examined for the sake of testing the method proposed here, the result being satisfactory. (auth)

34809 VERTEX FUNCTIONS OF BARYON AND BOSON. Isao Umemura and Keiji Watanabe (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto), 29: 893-907(June 1963).

The vertex functions of $NN\pi$, $\Lambda N\bar{K}$, and $\Lambda\Sigma\pi$ are investigated under the following assumptions: The elementary particles are p, n, Λ, π, K, and π_0, and the I-O-O symmetry holds in the high energy limit. The one-subtraction dispersion relation holds for the vertex function in which three particles are elementary and the unsubtracted one holds

when one of them is composite. Restricting ourselves to the two particles intermediate states, and assuming that the scattering amplitudes are known, the coupled dispersion relations for the vertex functions are obtained. Investigating their solutions, the following relations for the coupling constants are obtained: $g_{NN\pi} \simeq g_{\Lambda N K} \simeq 2g_{\Lambda\Sigma\pi}$. (auth)

34810 ANALYTICITY IN COUPLING CONSTANT, ANGULAR MOMENTUM AND ENERGY OF THE S-MATRIX FOR POTENTIAL SCATTERING. Gaku Konisi (Kwansei Gakuin Univ., Nishinomiya, Japan), and Takesi Ogimoto. Progr. Theoret. Phys. (Kyoto), 29: 908-14(June 1963).

It is shown that the amplitude for scattering by a superposition of the Yukawa potential is a meromorphic function of coupling constant g, angular momentum l, and linear momentum k. Regge poles for bound states are seen to be non-decreasing function of g. In the case of l real, poles in the g-plane are shown, as a function of energy ($E = k^2$), to be real analytic R-functions with no left-hand cut. Finally, a holomorphy domain of the S-matrix in three variables is obtained. (auth)

34811 NEUTRINOS, OLD AND NEW. Frederick Reines (Case Inst. of Tech., Cleveland). Science, 141: 778-83(Aug. 30, 1963).

The neutrino hypothesis of nuclear β decay is reviewed. Results are reported from a series of experiments that led to the conclusion that neutrinos exist in 4 states. (C.H.)

34812 SCATTERING OF 300-Mev PIONS ON HYDROGEN AND DEUTERIUM. I. B. Sokolova. Tr. Fiz. Inst., Akad. Nauk SSSR, 14: 61-116(1962). (In Russian)

The cross sections and the angular distributions for the elastic scattering of 300-Mev negative and positive pions on hydrogen and deuterium were determined. The phase analysis for the scattering of positive mesons on hydrogen requires S and P waves; the inclusion of D waves does not change the angular distribution and within experimental error it is not possible to say just what the D-wave contribution is. For S and P waves the phase shifts α_1 and α_3 do not have a linear dependence on the meson momentum as proposed by Orear. The α_{33} phase shift does not agree with the Chew and Low relation, but rather is in agreement with the energy dependence proposed by Mukhin and Pontecorvo. The phase analysis is not unique. For the isotopic spin $\frac{1}{2}$ state two series of phases are possible. The determined phase shifts agree with the dispersion relations for both negative and positive mesons assuming that the meson-nucleon interaction constant, f^2, is 0.08 to 0.10. The angular distributions for the elastic scattering of mesons on deuterium do not agree with the Green and Rockmore calculation in the impulse approximation. Agreement is obtained if it is assumed that the nucleon mass goes to infinity. The disagreement is apparently connected with the inconsistent calculation of the nucleon recoil. (TTT)

34813 INELASTIC INTERACTIONS OF π^- MESONS WITH NUCLEONS AT 6.8 Bev ENERGY. Shu-fen Wang, P'u-ying Cheng, Ch'un-hsun Lo, and Ts'en-ju Jeng. Wu Li Hsueh Pao, 18: 422-34(Aug. 1962). (In Chinese)

Inelastic interactions (130) of π^- mesons and nucleons were studied in nuclear emulsions at 6.8 Bev. The angular and momentum distributions of secondary protons and π^+ in the π^- center-of-mass systems are in good agreement with published data and in principle are described by the mechanism of peripheral interactions. The data were used for calculating the magnitude of the total energy of secondary particles (except protons) in their center-of-mass systems. The distribution according to total energy was correlated with the theoretical curve constructed for peripheral interactions in one-meson approximation. The peaks observed on the curve at ≈1.93 and 1.58 Bev were analyzed. (tr-auth)

34814 BUBBLE CHAMBER EXPERIMENTS ON THE SLOWING DOWN OF RELATIVISTIC ELECTRONS. G. Harigel, M. Scheer, and K. Schultze (Max-Planck-Institut für Physik und Astrophysik, Munich and Universität, Wurzburg, Ger.). Z. Naturforsch., 18a: 675-87 (June 1963). (In German)

The complete slowing down of electrons with initial energies up to 20 Mev in several materials was investigated with the aid of a bubble chamber. The real path lengths and penetration depths of electrons were evaluated; the distribution of these and some other derived quantities are given and discussed. The distributions of the path lengths which are essentially influenced by energy loss due to bremsstrahlung, are in good agreement with a theory of Blunck. (auth)

34815 CALCULATION OF ELECTRON-PHOTON CASCADES IN LEAD FOR A PRIMARY ENERGY OF 200 Mev. H. H. Nagel and Ch. Schlier (Universität, Bonn). Z. Physik, 174: 464-71(1963). (In German)

The development of 200-Mev electron-initiated showers was simulated by the Monte Carlo method on an electronic digital computer. Bremsstrahlung, ionization loss, and multiple scattering for electrons and pair production, Compton scattering, and photo-effect for photons were taken into account. The total cross sections for the various processes were partly corrected by empirical correction factors to provide the correct energy dependence. Electrons were followed down to 1.5 Mev total energy and photons to 0.26 Mev. The results were compared with experimental data and the Monte Carlo calculations of Messel et al. (auth)

34816 CONTRIBUTIONS OF REGGE POLES TO TOTAL CROSS SECTIONS AT HIGH ENERGIES. V. I. Nikanorov (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 44: 2184-5(June 1963). (In Russian)

A combined analysis was made of experimental data on total cross sections of π^--p, π^+-p, K^--p, K^+-p, p-p, $\bar{p}$-p, and p-n interactions at 5 Bev. The results were used for determining the parameters describing Regge pole contributions (vacuum, quasivacuum, and ω and ρ poles) to the simulated amplitude cross sections corresponding to processes at $t = 0$ (when t is the square of 4-momentum transmission in the center-of-mass system). (R.V.J.)

34817 ON CERTAIN METHODS FOR POLARIZATION AND ANALYSIS OF NEUTRON POLARIZATION AT MEDIUM ENERGIES. Yu. V. Taran and F. L. Shapiro (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksperim. i Teor. Fiz., 44: 2185-7(June 1963). (In Russian)

The known methods for thermal and resonance neutron polarization, based on the interference between magnetic and nuclear scattering, are limited in principle to neutron energies of 30 to 50 kev and in practice from 10 to 12 ev. An attempt was made to find a method for polarization and analysis of resonance neutrons at higher energies, based on the principle of nuclear interactions as a function of spin. The suggested method became quite realistic due to the successful development of a dynamic method for proton and He^3 polarization by optical pumping. (R.V.J.)

34818 STRANGE PARTICLES. Robert Kemp Adair and Earle Cabell Fowler. Interscience Tracts on Physics

and Astronomy, No. 15. New York, Interscience Publishers, 1963. 156p. $4.75.

Information on the interactions and properties of strange particles is included. Aspects of the formalism that aid interpretation of experimental results are discussed, and the analysis and interpretation of experimental results are emphasized. (D.C.W.)

34819 ELECTROMAGNETIC FORM FACTORS OF THE PROTON AND NEUTRON. T. A. Griffy, R. Hofstadter, E. B. Hughes, T. Janssens, and M. R. Yearian (Stanford Univ., Calif.). 29p. (CONF-122-10)

From International Conference on Nucleon Structure, Stanford, Calif., June 1963.

Proton form factors in the four-momentum-transfer range $q^2 = 4.6$ to 32.0 f^{-2} and neutron form factors in the range $q^2 = 2.5$ to 10.0 f^{-2} are measured by means of electron elastic scattering by protons and electron inelastic scattering by deuterons. (T.F.H.)

34820 ON THE STRUCTURE OF ELEMENTARY PARTICLES IN CLASSICAL ELECTRODYNAMICS. I. Prigogine and F. Henin (Université Libre, Brussels). 4p. (CONF-122-6)

From International Conference on Nucleon Structure, Stanford, Calif., June 1963.

For particles that can be characterized by three scalars (bare mass, electromagnetic mass, and electric charge), it is noted that there can be constructed a theory that is finite, relativistic, strictly causal, and that permits the definition of an energy tensor for the particle. (T.F.H.)

34821 CRYOGENIC TARGETS FOR ELECTRON SCATTERING. B. Chambers, R. Hofstadter, A. Marcum, and M. R. Yearian (Stanford Univ., Calif.). 5p. (CONF-122-2)

From International Conference on Nucleon Structure, Stanford, Calif., June 1963.

A remote-controlled cryogenic system is described that can be used to liquefy and maintain as many as 5 liquid hydrogen or deuterium targets for electron scattering studies. (T.F.H.)

34822 ELECTRON SCATTERING EXPERIMENTS ON THE NEUTRON AND PROTON. Karl Berkelman (Cornell Univ., Ithaca, N. Y.). 22p. (CONF-122-7)

From International Conference on Nucleon Structure, Stanford, Calif., June 1963.

The electric and magnetic "helicity" form factors of the proton are measured at 4-momentum transfers (squared) of 25 to 45 f^{-2}, by means of electron scattering by protons at high energies. The results are combined with other $e^- - p$ and $e^- - d$ experimental findings in order to show the proton form factors from 0 to 45 f^{-2} and the neutron form factors from 0 to 25 f^{-2}. (T.F.H.)

34823 [PRODUCTION OF POLARIZED PARTICLES.] P. Huber (Universität, Basel). 23p. (CONF-13-4)

From American Physical Society Meeting, Houston, Tex., Mar. 2, 1963.

The polarization of particles by electromagnetic interaction in atoms with subsequent ionization and acceleration of the polarized particles is discussed. The production of polarized deuterons and protons is considered. Apparatus for the production of polarized particles are illustrated. (C.E.S.)

34824 PRODUCTION OF THE 1385 Mev $(Y_1^*)^0$ IN 1.5 Bev/c $\pi^- p$ INTERACTION. L. J. Curtis, C. T. Coffin, D. I. Meyer, and K. M. Terwilliger (Univ. of Michigan, Ann Arbor). 39p. (CONF-46-90)

From American Physical Society 1963 Spring Meeting, Washington, D. C., Apr. 1963.

The reaction 1.508 Bev/c $\pi^- + p \rightarrow K^0 + \Lambda + \pi^0$ is studied in a spark chamber experiment; 127 events of this type are obtained. The reaction is dominated by production of the $(Y_1^*)^0$, with parameters $M_0 = 1381 \pm 4$ Mev, $\Gamma = 30 \pm 9$ Mev. The differential cross section for production of the $(Y_1^*)^0$ is (6.3 ± 0.9) [1 + (0.15 ± 0.27) cos θ-(0.35 ± 0.38) $\cos^2\theta$] μb/sr; the total production cross section is (70 ± 11) μb. Decay distributions of this resonance, assuming S and P waves in the production, are consistent with spin $^3/_2$, favoring it over spin $^5/_2$ with a likelihood ratio of 10/1. (auth)

34825 ΛK^0 AND $\Sigma^0 K^0$ PRODUCTION IN 1.5 Bev/c $\pi^- p$ INTERACTIONS. L. L. Yoder, C. T. Coffin, D. I. Meyer, and K. M. Terwilliger (Univ. of Michigan, Ann Arbor). 22p. (CONF-46-91)

From American Physical Society 1963 Spring Meeting, Washington, D. C., Apr. 1963.

476 ΛK^0 and 134 $\Sigma^0 K^0$ events are investigated in the experiment 1.508 Bev/c $\pi^- p \rightarrow \Lambda K^0$ and $\Sigma^0 K^0$. The Λ is produced mostly backward in the center of mass and has an average polarization of (-0.76 ± 0.14). The production and polarization angular distributions are well fit with SPD waves. The total ΛK^0 production cross section is (218 ± 23) μb. The Σ^0 production angular distribution has a small backward peak and an indication of a forward rise; it is consistent with either SP or SPD waves. The statistics are too poor to measure the Σ^0 polarization. (auth)

34826 PION-PROTON ELASTIC SCATTERING AT 2.00 Gev/c. D. E. Damouth, L. W. Jones, and M. L. Perl (Univ. of Michigan, Ann Arbor). 15p. (CONF-22-25)

From American Physical Society, 1963 Annual Meeting, New York, Jan. 1963.

The elastic differential cross sections for π^--p (2.01 Bev/c) and π^+-p (2.02 Bev/c) are measured. Maxima are observed in these cross sections at cos θ (cms) = 0.2. The widths of the diffraction peaks for the reactions are discussed, as regards their variations with energy. Totals of 7000 and 1400 events are analyzed for the π^- and π^+ scattering respectively. (T.F.H.)

34827 THEORY OF ELECTRON-DEUTERON SCATTERING. Loyal Durand, III (Yale Univ., New Haven). 24p. (CONF-122-5)

From International Conference on Nucleon Structure, Stanford, Calif., June 1963.

Information on the electromagnetic form factors of the neutron is obtained from the theory of inelastic electron-deuteron scattering. Problems in the analysis of these experiments that are related to the detailed structure of the deuteron and to the strong final state interactions between the emergent nucleons are considered. Problems arising from an ambiguity in the sign of the Dirac or charge form factor are also discussed. (C.E.S.)

Neutron Physics

Refer also to abstract 35188.

34828 (BRL-1204) NEUTRON REFLECTION AND FLUX VERSUS DEPTH FOR WATER, WITH AN APPENDIX, COMPARISON WITH RESULTS OF NATIONAL BUREAU OF STANDARDS. Frank J. Allen, Arnold Futterer, and William Wright (Ballistic Research Labs., Aberdeen Proving Ground, Md.). June 1963. 147p.

Detailed calculated results on neutron reflection and flux versus depth for water are given in the form of ma-

chine printouts. The angular and energy distributions of the reflected neutrons along with the energy-dependent and total flux at various depths are contained in tabular form on the printouts. Neutron number current, number flux and dose transmission as functions of thickness are also given in tabular form on the printouts. Information on reflection, including number current, number flux, dose and energy reflection factors as functions of incident energy and angle, is summarized. Some comparisons are made with results obtained by the National Bureau of Standards. (auth)

34829 (CONF-39-63) INVESTIGATIONS OF NEUTRON MODERATION WITH A PULSED SOURCE. A. E. Profio and J. D. Eckard (Massachusetts Inst. of Tech., Cambridge). [1963]. Contract [AT(30-1)-906]. 12p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

The slowing down times in water, toluene, and heavy water were obtained from measurements of capture gamma ray counting rates as a function of time after injection of a neutron burst. The times to the 1.46 ev resonance in In were 0.75 ± 0.5, 1.5 ± 0.3, and 4.25 ± 0.6 μsec for the three moderators. The corresponding times to a 0.4 ev energy in Cd were 1.75 ± 0.5, 3.25 ± 0.3, and 10.5 ± 1.0 μsec, respectively. Time-gated pulse height spectra measurements in a large liquid scintillation detector were made to separate fast from thermal neutron interactions by taking advantage of slowing down time spectrometry. Steady state pulse height spectra measurements in water and in water plus In illustrated the application of prompt gamma ray analysis to determination of capture rates. (auth)

34830 (CONF-39-65) FAST NEUTRON TRANSPORT IN LiN. V. V. Verbinski (Oak Ridge National Lab., Tenn.). [1962]. Contract W-7405-eng-26. 4p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Measurements of leakage spectra were made for fast neutrons penetrating slabs of LiH, and the results compared to predictions of a numerical calculation. (auth)

34831 (CONF-39-68) A MONTE CARLO CALCULATION OF PHOTONEUTRON SPECTRA FROM ANTIMONY-BERYLLIUM SOURCES. S. V. Topp (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). [nd]. Contract AT(07-2)-1. 7p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

The energy spectra from spherical Sb sources surrounded by spherical shells of Be were calculated for several sphere sizes and shell thicknesses. The calculation followed the neutrons from production through two scatterings. The average energy of the neutrons emitted in each geometry are given as well as spectra with and without neutron scattering. (D.C.W.)

34832 (CONF-39-71) DIFFERENCE EQUATIONS IN NEUTRON TRANSPORT THEORY. Bengt G. Carlson (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract [W-7405-eng-26]. 6p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

The advantages of the integral-difference formulation of the numerical neutron transport theory are illustrated by outlining the construction of a basic balance equation oriented toward numerical solution. A cylindrical case in multi-ray theory is considered. Solution by the diamond difference scheme is outlined; other schemes are briefly discussed. (D.C.W.)

34833 (DOFL-TR-1148) A STUDY OF TARGETS FOR MACHINE PRODUCTION OF 14-Mev NEUTRONS. Philip Berman (Harry Diamond Labs., Washington, D. C.). June 25, 1963. 17p.

A study was made of available target materials suitable for production of an intense pulse of 14-Mev neutrons by the $D(T,n)He^4$ reaction. A basic requirement of the target is that it be inexpensive enough to be expendable. The target types studied were clathrate, zeolite, tritiated organics, and metallic tritides. The study indicated that synthetic zeolite in which tritium oxide (T_2O) is absorbed would provide the required yield and would be inexpensive enough to be expendable. Experimental studies of such a target are recommended. (auth)

34834 (EUR-292.i) VALUTAZIONE DEL FLUSSO TERMICO IN MODERATORI PESANTI MEDIANTE SVILUPPI IN AUTOFUNZIONI. (Evaluation of Thermal Flux in Heavy Moderators by Means of Developments in Auto-Functions). Adelia Daneri and Adriana Daneri (Milan. Università. Istituto di Fisica Teorica). 1963. 25p.

The distribution of thermal neutrons in heavy gaseous moderators is studied. The problem of homogeneous infinite medium is treated by the Wilkins's equation. The spectrum of the operator corresponding to such an equation is as shown to be discrete. Assuming its completeness the flux is obtained by an expansion in series of numerically calculated eigenfunctions of such an operator. The problem of a slab system in the diffusion approximation is then analytically treated. (auth)

34835 (EUR-342.i) ASPETTI GENERALI DELLA TEORIA DEL RALLENTAMENTO. (General Aspects of the Theory of Retardation). B. Coppi and M. Francesio (Milan. Universita. Istituto di Fisica Teorica). 1963. 51p.

The different physical and mathematical aspects (models, approximations etc.) at the basis of the neutron slowing-down theory are examined. The system of equations (resolved by MUFT codes) in the well known P_1 and B_1 age-diffusion Greuling-Goertzel and Selengut Goertzel approximations is derived from the Boltzmann equation. Different considerations, especially on the Fermi-age approximation, are made on the above-mentioned approximations. In these approximations different expressions for τ factor are deduced, and the numerical values of τ are compared with the most recent experimental data. (auth)

34836 (EUR-350.i) IL PROGRAMMA LOUISE I PER CALCOLI DI CRITICITÀ E FLUSSI NELLO SCHEMA A MULTIGRUPPI E PIU REGIONI UNIDIMENSIONALI. (The LOUISE I Programme for Calculating Criticalities and Fluxes in the Layout Having Multi-Groups and More One-Dimensional Regions). G. Buffoni (Milan. Università. Istituto di Fisica Teorica). 1963. 82p.

The computer program Louise I, which calculates the criticality, constant and the critical flux of a reactor in the few group diffusion approximation in one dimension, is described. The program uses an iteration variable technique but is operatively as efficient as programs using finite difference methods. The Fortran listing of the program is included. (D.C.W.)

34837 (EUR-351.i) IL PROGRAMMA LOUISE II PER CALCOLI DI CRITICITA E FLUSSI NELLO SCHEMA A MULTIGRUPPI E PIU REGIONI BIDIMENSIONALI. (The LOUISE II Programme for Calculating Criticalities and Fluxes in the Layout Having Multi-Groups and More Two-Dimensional Regions). G. Buffoni (Milan. Università. Istituto di Fisica Teorica). 1963. 74p.

The program Louise II, in Fortran for the IBM 7090, calculates the critical flux and criticality constant of a reactor in the few group approximation in two dimensions. An iterative variational technique is used making the program operatively faster than a similar code (PDQ) using a finite differences method. Sample problems and the Fortran listing are included. (D.C.W.)

34838 (EUR-358.i) IL METODO DI GALERKIN SUL CALCOLO DEL FLUSSO TERMICO IN MEZZI ETEROGENEI NELL'APPROSSIMAZIONE DELLA DIFFUSIONE. (Galerkin Method for Calculation of Thermal Flux in Heterogeneous Media when Estimating Diffusion). Adelia Daneri and Adriana Daneri (Milan. Università. Istituto di Fisica Teorica). 1963. 25p.

The DESTHEC Code is used to calculate the thermal flux in the diffusion approximation in one dimension nonhomogeneous systems with slab, cylindrical, or spherical symmetry. Calling φ_j (E) the flux relative to the infinite medium, with the physical properties of the j-th medium, the flux in all the points of the system is approximated, as Selengut suggests, by a linear superposition of the different φ_j (E) with spatially dependent coefficients; then the coefficients are established by Galerkin's method. (auth)

34839 (EUR-367.e) REFLECTION AND TRANSMISSION OF NEUTRONS BY THE MULTIPLE COLLISION METHOD. T. Asaoka (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 67p.

The reflection and the transmission of neutrons for a homogeneous slab were dealt with analytically by the multiple collision method or the random walk approach, where the elementary processes of the neutron are followed statistically in order of its spatial movement. Under the assumption that the scattering of neutrons is spherically symmetric in the L system, the number of neutrons leaking from the slab with μ, a directional cosine of the emission angle, as a result of the N-th collision of an incident neutron was derived. The total number of the leakage neutrons, the total neutron current at the boundary of the slab, etc. were also written in the form of an infinite series of the spherical Bessel functions. The numerical results were obtained by truncating the sum of the first five terms; and it was shown, by comparing some results with the exact ones, that the present approximation gives a very accurate result. The critical condition of the slab in the one-group approximation was derived and was shown to exactly coincide with the one obtained previously. (auth)

34840 (NP-12662) INVESTIGATION OF THERMAL NEUTRON FLUX PERTURBATION IN A POLYETHYLENE MEDIUM BY USE OF GOLD FOIL DETECTORS (thesis). Edward C. Copeland and Roger L. Reasonover, Jr. (Naval Postgraduate School, Monterey, Calif.). 1961. 37p.

The neutron flux perturbation in a homogeneous thermal reactor, polyethylene moderated, was investigated experimentally by use of activated gold foils of varying thicknesses. The experimental data are compared with the theoretical predictions of Bothe and Skyrme, and with the modifications introduced by Tittle and by Ritchie and Eldridge. Experimental determination of the thermal neutron flux at the center of the core of the AGN-201 reactor indicates that Skyrme's theory and/or Skyrme's theory as modified by Ritchie and Eldridge give the best results over a range of foil thickness from two to ten mils. The greatest deviation of theoretical calculations from experimental data is less than 3%. Determinations of other investigators for gold detectors in graphite agree to within 3% with the predictions of the Skyrme theory. In water-moderated reactors experimental determinations have been compared with the Skyrme theory as modified by Ritchie and Eldridge and found to agree to 5%. (auth)

34841 THE NEUTRON COHERENT SCATTERING LENGTH FOR MAGNESIUM. T. M. Sabine and J. D. Browne (Australian Atomic Energy Commission, Lucas Heights, New South Wales). Acta Cryst., 16: 834(Aug. 10, 1963). (In English)

A confirmation of Bacon's value of the coherent scattering length of magnesium is given from neutron powder intensities measured for MgO. The value is $0.516 \pm 0.006 \times 10^{-12}$ cm. (R.E.U.)

34842 CALCULATION OF SLOWING-DOWN LENGTH. Peter Vértes. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 11: 205-13(1963). (In Hungarian)

A simple method for the calculation of the slowing-down length in various moderator mixtures is presented. The method is based on the use of the Laplace transformed P_1 equations. The use of the method is illustrated by the calculation of the slowing-down in hydrogen to graphite ratio. The slowing-down length for diphenyl and for spindle oil are determined separately. (auth)

34843 NEUTRON TRANSMISSION DATA. Frank J. Allen and Arnold T. Futterer (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Nucleonics, 21: No. 8, 120-1(Aug. 1963).

The results of Monte Carlo calculations on neutron transport in laterally infinite slabs of concrete, H_2O, polyethylene, and Nevada Test Site soil are presented for incident neutron energies of 0.5 to 14 Mev. The values agree well with experimental results. (D.C.W.)

34844 SEARCH FOR A PARTICLE-STABLE TETRA NEUTRON. J. P. Schiffer and R. Vandenbosch (Argonne National Lab., Ill.). Phys. Letters, 5: 292-3(July 15, 1963). (In English)

The existence of a particle-stable system of four neutrons was suggested under certain assumptions from the $He^4(\gamma, \pi^+)H^4 \rightarrow t + n$ reaction. The evidence consists of a resonance observed in H^4 at about 4 Mev above binding. Results are summarized in tabular form. (R.E.U.)

34845 MEASUREMENT OF THERMAL NEUTRON ABSORPTION COEFFICIENT OF BORAL. Yoshihiko Sasa and Tetsuzo Atoda. Rika Gaku Kenkyusho Hokoku, 39: 17-20(1963). (In Japanese)

34846 IMPULSE METHOD FOR THE INVESTIGATION OF PROPERTIES OF SLOW NEUTRONS. I. M. Frank. Tr. Fiz. Inst., Akad. Nauk SSSR, 14: 117-46(1962). (In Russian)

The possibility of using the impulse method for the investigation of properties of slow neutrons was explored. In particular it is hoped to use the method for the determination of the neutron diffusion coefficient D and its dependence on experimental conditions. The retardation of the neutrons is assumed to follow an exponential law, $e^{-\alpha t}$, where $\alpha = D\Omega + 1/T$; T is the neutron lifetime, and Ω is a geometric factor. In materials where the velocity distribution of the neutron moderation is constant with respect to a time which is less than the lifetime of the slow neutron then D becomes a physical constant, characteristic of the neutron's properties in the material. If D is constant then α depends linearly on Ω. This dependence can be found by studying several materials; by this means one can then determine D. By extrapolating to D = 0, the value of T can be found. The exponential dependence of the neutron gas density does not enter into the system all at once. The investigation of the length of the transition period can yield knowledge of the duration of the applicability of the sta-

tionary velocity distribution for the neutrons. In some materials, such as water, it may be useful to look upon the system as being a plate of a given thickness and of infinite extent. (TTT)

34847 INVESTIGATION OF THE PROCESSES FOR THE DIFFUSION AND STOPPING OF NEUTRONS IN DIFFERENT MEDIA AND THE MULTIPLICATION OF NEUTRONS IN A URANIUM-GRAPHITE HETEROGENEOUS SYSTEM WITH THE AID OF THE IMPULSE METHOD. A. V. Antonov. Tr. Fiz. Inst., Akad. Nauk SSSR, 14: 147-223(1962). (In Russian)

The processes connected with the diffusion and retardation of neutrons in various media were investigated with the aid of the impulse method. Several problems are discussed. The process of nonstationary diffusion of neutrons was studied in small blocks of moderators. These results were used to analyze the process for establishing equilibrium between the neutron gas and its surroundings. Diffusion parameters were determined for the following moderators: water, graphite, and beryllium. The neutron retardation process was investigated for graphite and a uranium-graphite heterogeneous system by measuring directly the average neutron velocities at different times after the onset of retardation. The impulse method was also applied to the study of the process of neutron multiplication in the uranium-graphite heterogeneous system. (TTT)

34848 AN ALGOL PROGRAM FOR THE TREATMENT OF NEUTRON SCATTERING BY A LIQUID SCINTILLATOR ACCORDING TO THE MONTE CARLO METHOD. Peter Laeuchli (Eidgenossische Technische Hochschule, Zurich). Z. Angew. Math. Phys., 14: 315-26(1963). (In German)

A complete ALGOL program is given for a Monte Carlo simulation of neutron scattering in a cylindrical liquid scintillator. The aim of the program is the calculation of the energy distribution of the luminescent radiation caused by the collisions of the neutrons with the H- and C-nuclei of the liquid. The results depend essentially on the initial energy of the neutrons and on the distance between the source and the cylinder. In many cases the efficiency of the process can be increased by prescribing the character of the first collision of each neutron. (auth)

34849 FAST NEUTRON PHYSICS. PART II. EXPERIMENTS AND THEORY. J. B. Marion and J. L. Fowler, eds. Interscience Monographs and Texts in Physics and Astonomy. Volume IV. New York, Interscience Publishers, 1963. p.985-2292. $45.00.

Results obtained from experiments involving fast neutrons are presented and the theoretical basis for the interpretation of these results are described. Various pertinent theories are advanced and examples based on neutron cross section data are illustrated. Extensive references and subject indexing are included. Separate abstracts are prepared for 20 of the 22 papers presented. Two papers were previously abstracted in NSA. (C.E.S.)

34850 NEUTRON TOTAL CROSS SECTION MEASUREMENTS. Dan W. Miller (Indiana Univ., Bloomington). p.985-1032 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

Experimental techniques for fast neutron total cross section measurements including general requirements imposed on the source, sample, and neutron detectors are discussed. Background and in-scattering corrections are considered. Particular techniques employed with accelerator sources, high-resolution techniques for resonance studies, and reactor techniques are discussed. Typical total cross section results from 120 kev to 100 Mev are considered and examples illustrated. Nuclear radii derived from total cross section measurements are also discussed. (C.E.S.)

34851 ANGULAR DISTRIBUTIONS OF ELASTICALLY SCATTERED NEUTRONS. M. Walt (Lockheed Aircraft Corp., Palo Alto, Calif.). p.1033-56 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

The experimental techniques for the determination of the angular distribution of scattered neutrons are described. Various geometries, neutron sources, detectors, and shielding are discussed. Experimental results and their corrections are summarized, and illustrative examples of differential cross section data are presented. (C.E.S.)

34852 OPTICAL MODEL THEORY OF NEUTRON SCATTERING AND REACTIONS. W. S. Emmerich (Westinghouse Research Labs., Pittsburgh). p.1057-1111 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

The optical model theory as developed from and applicable to fast neutron interactions is discussed. Historical background on the attempts to describe neutron interactions with a potential model is presented. The shape and radius of potential wells are considered. Optical model theory pertaining to the nuclear reaction scheme, spin-orbit coupling, neutron strength functions, nuclear structure, and reactor physics is discussed. Tables of optical model transmission coefficients and Legendre polynomial coefficients of elastic scattering cross sections are also presented. (C.E.S.)

34853 RESONANCE PROCESSES WITH FAST NEUTRONS. W. B. Willard (Oak Ridge National Lab., Tenn.), L. C. Biedenharn, P. Huber, and E. Baumgartner. p.1217-1316 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

A survey and summary of nuclear reaction theory and experiment as it applies to neutron induced processes in the resonance region are presented. A brief development of the Wigner theory is presented to obtain general features of the scattering matrix and to develop simple formulas for the analysis of experimental data. The problem of obtaining differential cross sections for scattering and reactions involving unpolarized neutrons is discussed. Considerations including the dependence upon the size of the internal region, Wigner sum rules, and γ-ray processes are included. Particular difficulties arising in the study of individual or slightly overlapping resonances are discussed. The measurement of elastic scattering differential cross sections with particular emphasis on gas recoil techniques is outlined. (C.E.S.)

34854 THE THEORY OF POLARIZATION IN REACTIONS AND SCATTERING. T. A. Welton (Oak Ridge National Lab., Tenn.). p.1317-77 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

A coherent derivation of formulas for the calculation of polarization effects in nuclear processes is presented. The treatment is non-relativistic. Parity conservation is assumed so that weak interaction processes are excluded. The relevant formulas for the problems of radiative neutron capture and photoneutron production are given. (C.E.S.)

34855 NEUTRON NONELASTIC COLLISION CROSS SECTIONS. R. C. Allen (Los Alamos Scientific Lab., N. Mex.), R. E. Carter, and H. Lyndon Taylor. p.1429-81 "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

The sphere method for measuring neutron nonelastic

collision cross sections is discussed. The detectors developed for this procedure are described. Relations between the nonelastic collision cross section, the observed transmission, and the final cross sections are considered. Nonelastic collision cross sections are listed for a number of elements from beryllium to bismuth. (C.E.S.)

34856 EXCITATION FUNCTIONS FOR NEUTRON INELASTIC SCATTERING. Janet B. Guernsey (Wellsley Coll., Mass.), and David A. Lind. p.1483-1524 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

Techniques for the measurement of gamma radiation following inelastic scattering and detection of conversion electrons and of metastable state excitation are discussed. The determination of absolute values for inelastic scattering cross sections and corrections to gamma yields and counter and neutron flux calibration are considered. A summary of current theories of inelastic scattering is presented. Representative experimental data for both light and heavy nuclei, together with excitation functions calculated from theory, are presented. (C.E.S.)

34857 STATISTICAL-MODEL THEORY OF NEUTRON REACTIONS AND SCATTERING. H. Goldstein (Nuclear Development Corp. of America, White Plains, N. Y.). p.1525-57 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

The assumptions and general predictions of the statistical-model theory of neutron scattering and reactions are presented. Reaction cross sections are discussed in relation to the partial and complete statistical model. (C.E.S.)

34858 GAMMA RADIATION FROM NEUTRON INELASTIC SCATTERING. J. M. Freeman (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.1559-1600 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

Suitable detectors for the gamma radiation from neutron inelastic scattering are discussed. Sodium iodide crystals, organic phosphors, and other detectors are considered. Experimental methods of detection such as the ring geometry, small sample techniques, closed geometry, the time-of-flight technique, and excitation of isomeric states are discussed. Detector calibration and a list of suitable γ calibration sources are presented. Coincidence measurements, deduction of level and decay schemes, and angular distribution measurements are also discussed. (C.E.S.)

34859 NEUTRON CROSS SECTIONS IN THE kev REGION. H. W. Newson (Duke Univ., Durham, N. C.) and J. H. Gibbons. p.1601-97 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

The theoretical basis necessary for the interpretation of neutron cross section curves of any sort is reviewed. Experimental techniques involving heterogeneous, continuous, and steady beams are discussed. The mechanical chopper, betatron, synchrocyclotron, linear accelerators, and the pulsed and modulated Van de Graaff accelerators are discussed. Methods of analysis of cross section curves are presented. Gas models, gap models, combinatorial models, and statistical shell models for the interpretation of level schemes and resonance spacings are also discussed. (C.E.S.)

34860 FAST NEUTRON CAPTURE CROSS SECTIONS. A. G. W. Cameron (Inst. for Space Studies, New York), N. H. Lazar, and H. W. Schmitt. p.1699-1773 of "Fast Neutron Physics, Part II." New York, Interscience Publishers, 1963.

The qualitative aspects of various methods for detecting capture events and for producing fast neutrons are considered. Applications of these methods and the determination of neutron intensity in specific experiments are discussed in connection with experimental results. Fast neutron capture cross sections are listed for a number of elements from Na^{23} to Bi^{209}. (C.E.S.)

34861 NEUTRON-INDUCED REACTIONS. F. L. Ribe (Los Alamos Scientific Lab., N. Mex.). p.1775-1864 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

Experimental results in which neutron-induced reactions provide the framework for clarifying various aspects of nuclear interactions are summarized. The main emphasis is on reactions in which charged particles are emitted as a result of bombarding target nuclei with fast neutrons. Also (n,2n) and inelastic scattering measurements for which the analogy to certain (n,p) reaction measurements is quite close are considered. Measurements determined with monoenergetic bombarding neutrons and that yield absolute cross section values are discussed. Tables of cross sections for (n,pγ), (n,$\alpha\gamma$), and (n,2n) reactions are presented. (C.E.S.)

34862 NEUTRON THRESHOLD MEASUREMENTS. J. B. Marion (Univ. of Maryland, College Park) and T. W. Bonner. p.1865-1905 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

Measurements of neutron threshold energies by charged-particle bombardment are considered. The determination of nuclear Q-values for ground and excited states is discussed. Methods for detecting threshold neutrons in the presence of large numbers of fast neutrons that leave the residual nucleus in ground or low-lying excited states are reviewed. The use of γ-ray detection in measurements of neutron thresholds for excited states is also considered. Tables of neutron threshold energies for various (p,n), (α,n), (d,n), and (He^3,n) reactions are presented. (C.E.S.)

34863 NEUTRON SPECTROSCOPY. J. M. Calvert and A. A. Jaffe (Univ. of Manchester, Eng.). p.1907-52 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

The performance of a number of fast neutron spectrometers is discussed. Energy resolution, energy measurements, efficiency, angular distribution measurements, and absolute and relative intensity measurements are considered. Neutron spectrometer applications in determining nuclear energy levels, energy level properties, neutron cross sections, and angular distributions are discussed. Experimental results obtained with neutron spectrometers are illustrated. (C.E.S.)

34864 COINCIDENCE STUDIES. G. C. Neilson (Univ. of Alberta, Edmonton, Can.), J. T. Sample, and J. B. Warren. p.1953-99 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

Reactions in which a fast neutron appears in coincidence with radiation or some other particle and for which a satisfactory interpretation can be obtained only if the energies of the coincident pair are known are discussed. Particular emphasis is placed on the (d,nγ) reaction. Basic requirements for the time-of-flight method are described. Time resolution parameters for a number of phototube-phosphor combinations are presented. Schematic diagrams are presented for pulse-shaping circuits and time-to-pulse-height converter circuits. Performance of the time-of-flight coincidence spectrometer is discussed. (C.E.S.)

34865 FISSION BY FAST NEUTRONS. R. L. Henkel (Los Alamos Scientific Lab., N. Mex.). p.2001-49 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

The determination of fast fission properties of fissionable nuclei is discussed. The systematics and fluctuations of fast fission cross sections and excitation functions are considered. Angular and mass distributions of fission fragments relative to the incident neutron beam direction are shown. Fission neutron energy spectra, emission probabilities, and number distribution widths are presented. Fission induced by the (d,p) stripping reaction is also discussed. (C.E.S.)

34866 CHANNEL ANALYSIS OF FISSION. John A. Wheeler (Univ. of California, Berkeley and Princeton Univ., N. J.). p.2051-2184 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

Equations are presented for the channel analysis of nuclear fission reaction rates. The theory of fission width is discussed. Quantum, semiclassical, and classical descriptions for the angular and mass distributions of fission products are given. Steps in the number of channels and fluctuations in fission cross sections are also considered. (C.E.S.)

34867 NOMENCLATURE SCHEME FOR EXPERIMENTAL MONOENERGETIC NUCLEAR CROSS SECTIONS. H. Goldstein (Columbia Univ., New York and Nuclear Development Corp. of America, White Plains, N. Y.). p.2227-35 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

A scheme for cross section terminology and associated notation is presented. Only monoenergetic microscopic cross sections are considered. The terminology is aimed particularly at the reporting of experimental results. (C.E.S.)

34868 THE n-p TOTAL AND DIFFERENTIAL CROSS SECTIONS IN THE ENERGY RANGE 0–40 Mev. J. L. Gammel (Los Alamos Scientific Lab., N. Mex.). p.2185-2226 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963. (LADC-3284)

An analysis of the neutron-proton differential and total cross section data in the energy range 0–40 Mev is presented. Contributions to the total cross section from states of the n-p system with orbital angular momentum ≥ 1 are discussed. The convergence of the effective range expansion and probable values of the effective range parameters based on theoretical calculations and existing analyses are considered. The shape dependent parameters, singlet effective range, and scattering lengths are also discussed. Equations for the modified effective range expansion are derived. (C.E.S.)

34869 RECENT DEVELOPMENTS IN NEUTRON DETECTION. F. W. K. Firk (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.2237-48 of "Fast Neutron Physics. Part II." New York, Interscience Publishers, 1963.

The pulse-shape discrimination method for neutron detection is discussed. The scintillation response of stilbene crystals to α particles, fast neutrons, and γ rays is presented. Schematic diagrams for three types of pulse-shape discrimination circuits are illustrated. The pulse-height spectra for liquid scintillators and glass scintillators loaded with boron or lithium are considered. Gamma sensitivity, time characteristics of the scintillation pulse, and neutron detection efficiency are also discussed. (C.E.S.)

34870 MEASUREMENT OF THE DIFFUSION PARAMETERS OF HEAVY WATER BY THE PULSED NEUTRON TECHNIQUE. Bimal K. Malaviya (Harvard Univ., Cambridge, Mass.) and A. E. Profio. 19p. (CONF-39-85)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Cylindrical containers of D_2O are filled so as to provide bucklings of 140 to 855 m^{-2}. Neutron pulses are introduced into these cylinders, and the decay constant of the (fast) neutrons in the D_2O is determined as a function of the buckling. It is noted that experimental and theoretical uncertainties render dubious any further diffusion parameters that might be inferred from the data. (T.F.H.)

34871 REACTOR NEUTRON PULSE PROPAGATION THROUGH MULTI-REGION MEDIA. G. H. Miley (Univ. of Illinois, Urbana). 5p. (CONF-39-73)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Neutron pulse propagation through multi-region media, consisting of a graphite thermal column terminated by a large water tank, with or without a boral separator between the two, was analyzed. It is found that the peak neutron flux is reached at some points in the water other than at the water-graphite interface. Calculations carried out with a Green's function using a time-dependent diffusion kernel and a volume source term are found to predict this earlier flux peaking in the water. (T.F.H.)

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Refer also to abstracts 34083, 35185, and 35190.

34872 (BAW-1281) THORIUM RESONANCE INTEGRAL EXPERIMENT. Quarterly Technical Report No. 2, April–June 1963. W. G. Pettus, C. Samuel, and M. N. Baldwin (Babcock and Wilcox Co. Critical Experiment Lab., Lynchburg, Va.). Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-3125. 25p. (EURAEC-802)

Activation data obtained at the Lynchburg Pool Reactor for various sized thorium metal and oxide rods are presented. A tentative calibration procedure is discussed, and the results of the calibration measurements are presented. The status of the Doppler-coefficient measurements is given, and the experimental method for this task is described. The results of a flux mapping through the sample test positions are given. An exact solution for the fundamental resonance-capture integral was obtained with the energy dependence of the neutron width retained. (auth)

34873 (CONF-13-5) STUDY OF ALPHA-PARTICLES EMITTED BY CsI(Tl) BOMBARDED WITH FAST NEUTRONS. F. Gabbard, T. Young, and J. L. Beach (Kentucky. Univ., Lexington). [1962]. Contract [AT(40-1)-2067]. 5p.

From American Physical Society 1963 Southwestern Meeting, Houston, Tex., Feb. 1963.

Alpha particles and protons emitted from CsI(Tl) bombarded by fast neutrons in the energy range 12.4–18.2 Mev were observed. Alpha particles were separated from protons using a circuit due to Biggerstaff. The excitation function for the sum of the $Cs^{133}(n,\alpha)$ and $I^{127}(n,\alpha)$ reactions was measured for the above energy range. The sum of the cross sections is 2.8 ± 0.3 mb at 12.4 Mev and increases monotonically to 11 ± 1 mb at 18.2 Mev. Spectra of the emitted alpha particles are presented. As previously observed by Bormann and Langkau, the alpha-particle spectra

are not well represented by the statistical model, and some sort of direct reaction mechanism or mechanisms appear to be important. The observed spectra are compared with calculations based on the statistical model. (auth)

34874 (CONF-13-7) DISINTEGRATION OF O^{16} AND C^{12} BY FAST NEUTRONS. E. A. Davis, T. W. Bonner, D. W. Worley, Jr., and R. Bass (Rice Univ., Houston, Tex.). [1967]. Contract [AT(40-1)-1316]. 17p. (TID-19046)

From American Physical Society 1963 Southwestern Meeting, Houston, Tex., Feb. 1963.

The disintegration of O^{16} and C^{12} by fast neutrons was studied using a grid-type ionization chamber filled with CO_2–Ar or CO_2–Kr mixtures. Monoenergetic neutrons for studying the reactions from 5.0–8.8 Mev were produced with the D(d,n)He^3 reaction using a gas target. The α-particle group from the $O^{16}(n,\alpha)C^{13}$ reaction leaving C^{13} in its ground state was studied over the entire energy range. The excitation function showed 21 resonances corresponding to excited states in O^{17}. The cross section varied from 2–206 mb. The α-particle group leaving C^{13} in its 1st excited state was studied from 7.6–8.7 Mev, the cross section increasing from about 3–12 mb. Unresolved α-particle groups leaving C^{13} in its 2nd- and 3rd-excited states were studied from 8.1–8.7 Mev, the cross section decreasing from an estimated 30–8 mb. The α-particle group from the $C^{12}(n,\alpha)Be^9$ reaction leaving Be^9 in its ground state was studied from 7.9–8.7 Mev. The cross section increased from 60–76 mb at 8.0 Mev and then decreased to 32 mb at 8.7 Mev. (auth)

34875 (EFINS-63-21) SOME POSSIBILITIES FOR UNUSUAL LIGHT HYPERNUCLEI. R. H. Dalitz and R. Levi Setti (Chicago. Univ. and Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies). Apr. 1963. Contract AT(11-1)-264. 22p.

Some possibilities concerning the stability, formation, and identification of Λ-hypernuclei corresponding to core nuclei (generally with $I \geq 3/2$) away from the stability valley are considered. The identification of such hypernuclei may be rather informative concerning the existence and properties of such little-known nuclei. For neutron-rich species, e.g. ${}_{\Lambda}H^6$, ${}_{\Lambda}He^8$, etc., the possible confusions of their major decay modes with (and their separation from) similar well-established modes of more abundant hypernuclei are discussed. The expectation that narrow resonance levels (with lifetimes $\geq 10^{-21}$ sec) should exist for certain hypernuclear systems (e.g. the $p - {}_{\Lambda}He^4$ system) is also mentioned briefly, since the production and observation of such resonance states could be achieved with existing techniques. (auth)

34876 (HEPL-264) ELECTRON-PROTON COINCIDENCES IN INELASTIC ELECTRON-DEUTERON SCATTERING. M. G. Croissiaux (Stanford Univ., Calif. High-Energy Physics Lab. and Strasbourg. Université. Centre de Recherches Nucléaires). June 1962. Contract N6onr-25116. 58p.

Electron-proton coincidences in electron inelastic scattering by deuterons were used to study proton form factors. Two magnetic spectrometers were used with an electron counter and a multichannel system to count the coincidences. The experimental apparatus, procedure, and problems are described, and calculation of the cross section (particularly the corrections) is examined. The difference of the experimental and theoretical cross sections ($4.2 \pm 0.5 \times 10^{-32}$ and 3.37×10^{-32} $cm^2/ster^2$ Mev) might be due to a difference of the proton form factors in a bound state from those in the free state. Other possible causes of the discrepancy must also be considered. (D.C.W.)

34877 (JINR-P-1277) OTNOSHENIE SECHENII OBRAZOVANIYA IZOMERNOI PARY Sc^{44} V REAKTSIYAKH S TYAZHELYMI IONAMI. (Ratio of Cross Sections for Production of an Sc^{44} Isomer Pair in Reactions Involving Heavy Ions). V. V. Bredel, B. A. Gvozdev, and V. A. Fomichev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Reactions). 1963. 11p.

The energy dependence of the ratios for the production of an Sc^{44} isomer pair in the reactions $Al^{27}(Ne^{20},2pn)$, $Al^{27}(Ne^{22},\alpha n+2p3n)$, and $S^{32}(O^{16},3pn)$ was measured. The excitation functions of the reactions leading to the production of Sc^{44m} and Sc^{43}, as well as Sc^{43} and Sc^{46} have the shape characteristic of the reactions occurring via the compound nucleus. From the energy dependence of the isomer ratio, it is concluded that the scandium isotopes are produced in reactions that have collision parameters corresponding to angular momenta less than $J_{crit.} = 25\hbar$. (auth)

34878 (LA-2234(Del.)) AN INTEGRAL EXPERIMENT TO MEASURE THE TRITIUM PRODUCTION FROM Li^7 BY 14 Mev NEUTRONS IN A LITHIUM DEUTERIDE SPHERE. Marvin E. Wyman (Los Alamos Scientific Lab., N. Mex.). Nov. 1954. Revised June 1958. Contract W-7405-eng-36. 43p.

A sphere of LiD 2 ft in diameter was irradiated by 2×10^{15} 14-Mev neutrons. Samples of Li^7 metal were positioned at various radii for the irradiation. An analysis (described) of the samples for tritium gave upper limits of 0.445 and 0.48 for the triton production by Li^7 per 14-Mev neutron in both normal LiD and Li^7D environments for a 30-cm sphere. The results were extrapolated to an infinitely large system. (auth)

34879 (LA-2235) A MEASUREMENT OF THE $Li^7(n,n'\alpha)T$ CROSS SECTION FOR SEVERAL NEUTRON ENERGIES FROM 4 TO 15 Mev BY ABSOLUTE COUNTING TECHNIQUES. Marvin E. Wyman and Munson M. Thorpe (Los Alamos Scientific Lab., N. Mex.). June 1958. Contract W-7405-eng-36. 20p.

The $Li^7(n,n'\alpha)T$ reaction cross section was measured at several neutron energies between 4 and 15 Mev by absolute counting of the tritium betas. At neutron energies of 4.0 ± 0.2, 8.0 ± 0.1, and 14.8 ± 0.2 Mev, values of 105 ± 15, 450 ± 60, and 305 ± 20 mb were obtained. The apparatus, procedure, and other results are described; and cross sections obtained by emulsion techniques are given for comparison. (D.C.W.)

34880 (NP-13018) $Ne^{20}(p,p'\gamma)$ ANGULAR CORRELATIONS AT LOW ENERGY. H. Hulubei, N. Martalogu, M. Ivaşcu, N. Scîntei, A. Berinde, I. Neamu, and J. Francz (Academia R.P.R. Institutul de Fizică Atomică, Bucharest). Mar. 1963. 15p.

The $Ne^{20}(p,p'\gamma)$ 1.63 Mev angular correlation was measured in the 5.2 to 6.1 Mev energy range, where the elastic and inelastic excitation functions vary in a compensating manner. Strong angular correlation functions of the form $A + B \sin^2 2(\theta - \theta_0)$ where θ_0 defines the axis of symmetry were obtained. The angular correlation curves are insensitive to a change of the incident proton energy, and θ_0 is situated in the proximity of the recoil direction θ_R of the nucleus. These facts could constitute an argument in favor of the direct interaction mechanism. (auth)

34881 (NP-13050) THE EFFECT OF QUADRUPOLE VIBRATIONS ON l-FORBIDDEN M1 TRANSITIONS. Raymond A. Sorensen (Carnegie Inst. of Tech., Pittsburgh). July 19, 1963. Contract 760(15) NR012-202. 13p.

The effect of quadrupole vibrations on l-forbidden M1 transitions is computed using the wave functions resulting

from the shell model with a residual pairing plus $P^{(2)}$ force. These wave functions for low states of an odd nucleus are a linear combination of a spin j quasi-particle and spin j' quasi-particles coupled to 2+ phonons to angular momentum j. The one-phonon components of the wave functions allow 1-forbidden M1 transitions to proceed both via the single particle and collective M1 operators. The calculation shows that this quadrupole coupling can explain most of the observed transition rate in a number of cases, while in a few cases, particularly for the odd-N nuclei fast transitions occur which are still unexplained. In addition, it is shown that the E2 contribution to these transitions while expected to be enhanced to several times single particle in most cases, nevertheless usually makes only a very small contribution to the total rate. (auth)

34882 (NP-13051) Cr^{51} NUCLEAR ORIENTATION IN A CERIUM MAGNESIUM NITRATE CRYSTAL. Technical Report No. 5. H. F. Taylor, Jr., and R. C. Sapp (Kansas. Univ., Lawrence). Aug. 1, 1963. Contract Nonr 2775(00). 21p.

Cr^{51} nuclei were aligned in Cr^{3+} ions introduced into a slightly cloudy, spherical single crystal of cerium magnesium nitrate and magnetically cooled to temperatures down to 1/325 deg K^{-1}. Angular distribution and linear polarization data are interpretable on the basis of paramagnetic resonance information, if in addition the presence of intermediate state reorientation is accounted for by coefficients Q_k in the Legendre polynomial expansion of the radiation pattern $W(\theta) = 1 + A_2P_2 + A_4P_4$. It was found that $Q_2 = 0.40 \pm 0.04$, $Q_4 = 43 \pm 12$ at $1/T = 325$ if $\delta = \pm (E2/M1)^{1/2} = +0.44 \pm 0.05$. These results are contrasted with those of an earlier experiment, and compared with a theoretical treatment of reorientation by static, isotropic hfs coupling which yields in the hard-core limit at this temperature $Q_2 = 0.61$. (auth)

34883 (ORNL-3455) A LITERATURE SURVEY OF NONELASTIC REACTIONS FOR NUCLEONS AND PIONS INCIDENT ON COMPLEX NUCLEI AT ENERGIES BETWEEN 20 Mev AND 33 Gev. H. W. Bertini (Oak Ridge National Lab., Tenn.). Aug. 23, 1963. Contract W-7405-eng-26. 117p.

Experimental data on nonelastic reactions of protons, neutrons, π^+, and π^- with complex nuclei at incident energies of 20 Mev to 33 Bev were surveyed. The material is grouped according to the incident particle in the above order. Information on the measured quantity, experimental arrangement, and the experimental error is included. The 200 publications used in the survey, most of them abstracted for Physics Abstracts, are listed. (D.C.W.)

34884 (TID-19047) THE DISINTEGRATION OF SILICON BY FAST NEUTRONS. B. Mainsbridge, T. W. Bonner, and T. A. Rabson (Rice Univ., Houston, Tex.). [196?]. Contract [AT(40-1)-1316]. 23p. (CONF-13-6)

From American Physical Society 1963 Southwestern Meeting, Houston, Tex., Feb. 1963.

The $Si^{28}(n,p)Al^{28}$, $Si^{28}(n,\alpha)Mg^{25}$, and $Si^{29}(n,\alpha)Mg^{26}$ reactions were observed in a silicon solid state detector with a barrier depth equivalent to the range of a 7.5-Mev proton. A yield curve for the reactions was measured between neutron energies of 4.6 and 8.5 Mev with an energy spread between 80 and 40 kev. At $E_n = 8.5$ Mev, transitions to two levels of Mg^{26}, four of Mg^{25} and nine of Al^{28} were observed. In the disintegration of Si^{29}, strong resonant structure was observed and below $E_n = 6$ Mev, both reactions are strongly inhibited by the coulomb barrier. Charged particle penetrability calculations predict the relative magnitudes of the Si^{28} (n,α) and (n,p) reaction cross sections. A fast neutron spectrometer using a Si^{29} solid state counter is proposed. (auth)

34885 (TID-19176) YIELDS OF POLONIUM AND BISMUTH NUCLIDES FROM Bi^{209} AND RECOIL STUDIES OF $Bi^{209}(p,p2n)Bi^{207}$ REACTION AT 450 Mev. William R. Pierson (Ford Motor Co., Dearborn, Mich.); and Nathan Sugarman (Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies). [1963]. Contract AT(11-1)-1167. 25p.

The radioactivity of Bi^{207} produced in the 450-Mev proton bombardment of Bi^{209} was measured. The yield ratios Bi^{205}/Bi^{207}, Bi^{206}/Bi^{207}, and Po^{207}/Bi^{207} were determined to be 0.77 ± 0.16, 0.83 ± 0.19, and 0.224 ± 0.013, respectively. These ratios, and Po/Bi ratios for other isobaric pairs of nuclides, are lower than values given by the Metropolis Monte Carlo intranuclear cascade calculations. Examination of available data on absolute yields of Po and Bi nuclides shows that there is an underestimation of $Bi^{209}(p,pxn)$ yields in the calculation, a larger discrepancy occurring at Bi^{207} than for lighter Bi nuclides (larger x values). New Monte Carlo calculations by Bertini, using a step function for the nuclear density, give slightly better agreement with experimental values if a greater radial extension is used. Recoil properties of Bi^{207} from 450-Mev proton bombardment of Bi^{209} were measured and compared with results derived from the Metropolis calculations. Over-all agreement is satisfactory, but the transverse momentum component seems overestimated by the calculations, a result found earlier in work with light Bi nuclides. 32 references. (auth)

34886 (UCRL-10783) TOTAL-REACTION CROSS-SECTION MEASUREMENTS FOR CHARGED PARTICLES (thesis). Bruce D. Wilkins (California. Univ., Berkeley. Lawrence Radiation Lab.). May 9, 1963. Contract W-7405-eng-48. 148p.

Total reaction cross sections have been measured for 10-Mev protons, 22.4-Mev deuterons, and 40-Mev alpha particles on Be, C, Al, Ti, V, Fe, Ni, Cu, Zn, Zr, Nb, Mo, Rh, Ag, Sn, Ta, Au, Pb, Bi, and Th. A beam attenuation method that utilized millimicrosecond electronic techniques was used; these techniques made possible 3% counting statistics to be obtained in 20 minutes. The total reaction cross section σ_R shows structure as a function of A in the vicinity of Ni for proton and alpha-particle bombardments. The results of an optical-model analysis for 10-Mev protons on Cu, Ni, Al, and Ag indicate that good fits to σ_R and the elastic-scattering angular distributions could only be obtained by using a Gaussian form factor, located on the nuclear surface, for the imaginary optical potential. Furthermore, an optical-model analysis of 48-Mev alpha particles on C^{12} indicates that the addition of total reaction cross-section data places a powerful constraint on the shape of the imaginary potential at the extreme surface of the nucleus. The experimental techniques used in these measurements are discussed in detail. Improvements in technique for future measurement of σ_R are suggested. 92 references. (auth)

34887 (UCRL-10865) I. TENSOR-FORCE EFFECTS IN THE NUCLEAR SHELL THEORY. II. NUCLEAR SPECTROSCOPIC STUDIES OF ISOMERIC STATES IN ODD-ODD YTTRIUM NUCLEI (thesis). Yeong E. Kim (California. Univ., Berkeley. Lawrence Radiation Lab.). June 12, 1963. Contract W-7405-eng-48. 185p.

The low-lying energy levels of odd-odd nuclei near the doubly closed shell (Y^{90}, Bi^{208}, Bi^{210}, and Tl^{208}) are calculated with finite-range central and tensor forces to the first order by means of the j-j coupled odd-group model. The two-body matrix elements for the central and tensor forces

are expressed in the j-j representation, from which a generalization to off-diagonal matrix elements is obtained in the limit of zero range. A nucleon-nucleon Gaussian potential without a hard core based on the free two-nucleon potentials of Blatt-Jackson and Brueckner-Gammel-Thaler is used for the residual interaction. Eigenvalues and eigenvectors are presented and compared with experimental spectra. The tensor-force effects are examined in detail as a function of the force range for the nuclei Y^{90} and Bi^{210}. A tensor force with reasonable range and strength accounts for the 1- state of the h_9g_9 multiplet being the ground state of Bi^{210}, instead of the 0− predicted by central forces. The low-lying energy levels of Po^{210} are also calculated with the same residual force used for Bi^{210} in order to obtain the RaE beta-decay matrix-element ratio $i(r)/(\sigma x r)$. It is shown that the ground-state wave functions for Bi^{210} and Po^{210} are consistent with the experimentally determined RaE beta-decay matrix-element ratio and the measured magnetic dipole moment of Bi^{210}. The ground-state wave function for Y^{90} is also consistent with the measured magnetic dipole moment of Y^{90}. A high-spin (J = 11) isomeric state in Po^{210} is predicted with an estimated gamma partial lifetime of the order of microseconds. A 48 ± 1 min isomeric level in Y^{86} was produced by irradiations of rubidium (natural and enriched in Rb^{85}) with alpha particles and of strontium (natural and enriched in Sr^{86}) with deuterons. Two transitions with energies 10.15 ± 0.1 and 208.0 ± 0.3 kev were observed in the decay of Y^{86m}. From the L sub-shell ratios the multipolarity of the 10-kev transition was determined to be E3. The K-conversion coefficient of the 208-kev transition is $\epsilon_K = 0.04 \pm 0.01$. A possible decay scheme of Y^{86m} is suggested. The energy of the isomeric transition in Y^{90m} was measured to be 202.4 ± 0.3 kev by use of a permanent-magnet 180 deg spectrograph. 95 references. (auth)

34888 (UCRL-10872) HYPERFINE STRUCTURE SEPARATION, NUCLEAR MAGNETIC MOMENT, AND HYPERFINE STRUCTURE ANOMALY OF CESIUM-131 (thesis). Richard D. Worley (California. Univ., Berkeley. Lawrence Radiation Lab.). June 13, 1963. Contract W-7405-eng-48. 91p.

The atomic-beam magnetic-resonance method was used to obtain the hyperfine structure separation $\Delta\nu$, the nuclear magnetic dipole moment μ_I, and the hyperfine structure anomaly Δ, of Cs^{131}. Independent values of μ_I and $\Delta\nu$ were obtained by observing one of the $\Delta F = \pm 1$ doublets in a field-independent region. The measurements were made for the $^2S_{1/2}$ electronic ground state; the values obtained are as follows: $\Delta\nu = 13181.3805\ (30)$ Mc/sec; $\mu_I = 3.525\ (4)$ nm; $g_I = 7.678\ (8) \times 10^{-4}$; $^{131}\Delta^{133} = -0.65\ (10)$ %; and $^{131}\Delta^{135} = -0.61\ (10)$ %. The values of μ_I and g_I are not corrected for diamagnetic shielding. A theoretical nuclear magnetic moment was calculated by using configuration mixing theory (CMT). The above anomalies were compared with the Bohr-Weisskopf theory and the CMT. Experimental values of the anomalies agree with the predicted values to within the estimated errors, and the ground-state configuration of Cs^{131} appears to be a mixture of $2d_{5/2}(1g_{7/2})^4$ and $(1g_{7/2})^2(2d_{5/2})^3$ configurations. (auth)

34889 (AEC-tr-5968) RESONANT EXCITATION OF THE ISOMERIC STATE OF Ag^{107} WHICH HAS A MEAN LIFE-TIME OF 63 SECONDS. G. E. Bizina, A. G. Beda, N. A. Burgov, and A. V. Davydov (Akademiya Nauk S.S.S.R. Institut Teoreticheskoĭ i Eksperimental'noĭ Fiziki). Translated by A. L. Monks (Oak Ridge National Lab., Tenn.). 1963. 12p.

A Mössbauer effect method was used to study the resonant excitation of isomeric Ag^{107} with a mean life time of 63 sec and an energy of 93.5 kev. By measuring, under low background conditions, the gamma activity of an irradiated sample that was removed from the primary gamma source, the absorption of a very small part of the total gamma-ray current inpinging on the sample was detected. The gamma-ray resonant scattering cross section magnitude was determined to be $(0.74 \pm 0.20) \times 10^{-30}$ cm^2, much less than the 5.6×10^{-30} cm^2 value derived from the estimated effective line width. Apparently the effective line width exceeds by 7.5×10^5-fold the natural width. (auth)

34890 THE THEORY OF THE PASSAGE OF γ-QUANTA THROUGH MATTER. V. S. Galishev. At. Energ. (USSR), 14: 453-7(May 1963). (In Russian)

As a result of multiple scattering, the attenuation of γ radiation as a function of the depth of penetration in an absorber cannot be described by a simple exponential expression. The attenuation depends on the energy of the source and the geometry of the system. One of the strictest calculation methods (L Spencer et al. J. Res. Nat. Bur. Stand. 46: 446 (1951); H. Goldstein et al. NYO-3075 (1954)) involves the integral-differential kinetic equations of the proton density function with 3 variables; however, the method can be used only for an infinite medium. Therefore, the simplest limiting problem in the passage of γ quanta through the matter is considered, assuming that a monochromatic γ beam falls normally on a plane-parallel sheet of a finite thickness a in the direction of the x axis, being infinitely thick in the y and z directions. The photon current density leaving the surface (x = a) and the inverse current in the opposite direction (x = 0) are taken into consideration. The integral-differential equation of the problem calculated under boundary conditions for the current density of scattered γ quanta in the n-th approximation leads to Legendre-type 2n system of first-order differential-integral equations for the divergence coefficients of the flux density of the scattered γ quanta. Arbitrary constants were determined for 2n boundary conditions; definitive results were obtained only for n = 1, giving the spectral distribution of the flux density of the scattered γ-quanta at a given distance from the source. (TTT)

34891 A DIFFERENTIAL EQUATION FOR THE THERMALIZATION OF NEUTRONS IN INFINITE HOMOGENEOUS MEDIA. N. I. Laletin. At. Energ. (USSR), 14: 458-64(May 1963). (In Russian)

The problem of calculating the slow neutron spectrum in a homogeneous medium with constant sources was examined. On the basis of the solution for cases not involving absorption and when the medium consists of heavy atoms ($m \gg 1$) and of hydrogen atoms (m = 1), a second-order differential equation was obtained; the equation may be used for the asymptotic solution in the case of a monatomic gas with an arbitrary mass m; its validity may be extended to apply to a medium with an absorber. The values were so chosen that they could be easily determined by experimental methods; they included the cadmium ratio of the absorber and the ratio of the total absorption cross sections for U^{235} and Pu^{239} on the basis of averages calculated from the spectra. (TTT)

34892 ELASTIC AND INELASTIC SCATTERING OF α PARTICLES ON ALUMINUM-27. K. P. Artemov, V. Z. Gol'dberg, and V. P. Rudakov. At. Energ. (USSR), 14: 482-4(May 1963). (In Russian)

A regular alternation of maxima and minima is a characteristic feature of the angular distribution curves of elastically and inelastically scattered α particles having energies much higher than the Coulomb barrier. A special

"phase-rule" was derived for even and odd excited states. Data obtained from measurements of the elastic and inelastic scattering of α particles with energies of 40, 38, and 36 Mev on Al^{27} carried out with a 1.5-m cyclotron, were analyzed. A high-pressure ionization chamber with an energy resolution of 1.2% for the 40-Mev particles and an angular resolution of 0.8°, was used for recording the particles. Two groups of inelastically scattered α particles, corresponding to the excitation of the first 2 levels and to a third level (Q = −2.22 Mev) of the Al^{27} nucleus, were measured. The radius of interaction of the particles with the Al^{27} nucleus was estimated at 5.5 Fermi; the 2.2-Mev state of Al^{27} was found to possess positive parity. A formula was derived for calculating the moments of quadrupole deformation. The cross section divided by k^2 yielded an energy-independent value. The data obtained may be explained on the basis of the rotary model and the diffraction theory. (TTT)

34893 FORMATION CROSS SECTIONS OF KRYPTON AND XENON ISOTOPES IN THE 680-Mev PROTON INDUCED FISSION OF URANIUM. A. N. Dobronravova, L. K. Levskii, A. N. Murin, and N. E. Titov. At. Energ. (USSR), 14: 484-7(May 1963). (In Russian)

Following up previously reported studies on the relative yields of Xe and Kr fission fragments (Geokhimiya 6: 540 (1962)), 2 U targets were exposed to 680-Mev protons in the internal beam of the synchrophasotron of the Joint Institute for Nuclear Investigations, melting them in Ta crucibles by high-frequency heating. The gases released were collected on activated carbon at −183°C and the chemically active gases separated by CuO at 600°C. The isotopic concentrations were obtained by the isotopic dilution method: the absolute number of Xe^{130} and Kr^{86} atoms were found to be 3.95×10^{12} and 5.21×10^{12} per gram of U, respectively. A special mass spectrograph was used for the automatic recording of the 11 Xe isotopes with mass numbers ranging from 124 to 136; a similar system was used for the study of the Kr, Ar, and Ne isotopes. The ability to pass rapidly from one element to the other made it possible to avoid an excessive decay of the samples. The fission of U induced by the 680-Mev protons yielded a broad, flat maximum. It was assumed that in the Xe isotope range (mass numbers from 124 to 136) the total cross section $\sigma(A) = \sigma(131) = 36.4$ millibarn. The half width of the distribution curve in this mass range is about 3.5 mass units; the results agree well with the data reported by A. Pappas and J. Alstad (J. Inorg. and Nucl. Chem. 17: 195 (1961) No. 3-4). (TTT)

34894 THE EFFECT OF THE POLARIZATION OF NEUTRONS ON THEIR PASSAGE THROUGH VARIOUS MEDIA. P. S. Otstavnov. At. Energ. (USSR), 14: 487-8 (May 1963). (In Russian)

In the case of a spherically symmetrical central field, the differential cross section of the elastic scattering of unpolarized neutrons is defined by a formula which is independent from the azimuthal angle. Scattering of fast neutrons on nuclei results in their partial polarization; i.e., by scattering under a given angle, most of the neutrons will be at the spin state. On the basis of a hypothetical experiment it was concluded that the neutrons falling on a medium are not scattered at random but tend to twist under the influence of the spin-orbital forces. After the second scattering, the neutrons are more likely to leave the medium instead of penetrating it more deeply. This effect was calculated for the case of Mg and a neutron energy of $E_n = 0.240$ Mev. Neglecting the losses due to elastic scattering, the ratio of the twice-scattered neutrons was estimated at about 7 : 1, which means that 7 times more neutrons will leave the medium than stay within it. For Be-scattered neutrons at an angle of 110° and a neutron energy of $E_n = 3.1$, this ratio is about 2. (TTT)

34895 ANGULAR NEUTRON ENERGY DISTRIBUTION AT THE BOUNDARY OF TWO MEDIA. V. A. Dulin, Yu. A. Kazanskii, and I. V. Sugar. At. Energ. (USSR), 14: 488-90 (May 1963). (In Russian)

After having placed a fast neutron source in a graphite layer, at 20 cm from the interface boundary, the spectrum of scattered neutrons which leave the flat graphite slab under various angles were determined. Values were obtained in the angular and energy ranges from 20 to 70° and from 1.3 to 3.9 Mev, respectively; the results represent the solution of the kinetic equation at the graphite-water boundary for the given geometry. The neutrons were obtained by the $H^2(H^2,n)He^3$ reaction at a deuteron energy of 900 kev. A single-crystal fast-neutron scintillation spectrometer was used for recording the neutron pulses. It was found that even at 70° the measured neutron amplitude distribution includes not more than 4% of γ radiation pulses. By integrating the angular energy distributions in the 0 to 180° range, it was possible to obtain the neutron energy distribution at the graphite–water interface. Angular energy distribution curves were also determined for the 1.3 to 3.9 and 3.5 to 3.9 Mev groups with single scattering, by both considering and neglecting the energy losses. Differences were found between the 2 groups; these differences reflect the effect of multiple scattering phenomena. (TTT)

34896 LOW-ENERGY γ-RADIATION OF THE ELEMENTS OF THE URANIUM AND THORIUM SERIES. B. I. Khazanov. At. Energ. (USSR), 14: 499-501(May 1963). (In Russian)

A spectrometric device, operating in the soft γ radiation and x radiation range, made it possible to carry out measurements in the 5 to 200 kev range, in which the contribution of the elements at the beginning of the natural radioactive series is most important. A scintillation spectrometer, a spectrometer provided with lateral proportional counters, able to record radiations in the 5 to 40 kev range, and a multichannel analyzer were used for the measurements; the system had a resolution of 9% for the Cs^{137} (E = 660 kev) lines. The radiation of U and Th separated radiochemically from equilibrium ores, was examined. The Th spectrum exhibited strong lines in the 10- to 20-kev range, corresponding to L_{α_1}-, L_{β_1}-, and L_γ- (E = 10.5 to 13 kev; E = 13 to 16 kev, and E = 20 to 23 kev). The contributions of MsTh and Th + RaTh with the decay products were nearly identical. The results pointed to a strong internal conversion as shown also by absence of string lines in the 57 to 59 kev region. For studying U, an oxide preparation was examined. Beyond 50 kev, the γ radiation of U^{235} was the controlling one but in the 60 to 90 kev range the UX lines were most important. In the L range the U + UX spectrum was found similar to that of Th. A peak in the U + UX spectrum is due to RaB, Ra, and RaC. In the soft radiation range the spectrum of U in equilibrium is close to that of Ra, except in the 184-kev region. (TTT)

34897 SYNTHESIS OF A NEW ISOTOPE OF ELEMENT 102. E. D. Donets, V. A. Shchegolev, and V. A. Ermakov. At. Energ. (USSR), 14: insert between 500 and 501(May 1963). (In Russian)

An isotope of element 102, with the mass number of 256 was synthetized. The isotope was found to be α active, with a half life of about 8 seconds. The synthesis was carried out by means of the $U^{238}(Ne^{22},4n)102^{256}$ reaction, and the isotope identified by its daughter, Fm^{252}. The Fm^{252} nuclei

were separated from the other nuclear reaction products by collecting the recoil nuclei after α decay by an electric field, high resolution α spectrometry and ion exchange techniques. A multiply charged, high-intensity, internal cyclotron beam of Ne^{22} was used for the experiments. The spontaneous decay half life was found to be several times longer than expected on the basis of studies of element 102 at the Lawrence Radiation Laboratory. (TTT)

34898 A CALCULATION OF THE MATRIX ELEMENTS IN SOME BETA TRANSITIONS. P. Lipnik (Universite, Louvain, Belg.). Bull. Soc. Belge Phys., Ser. III, No. 2, 114-15(1962). (In French)

The matrix elements for the β^- decays of Cl^{38}, K^{42}, As^{76}, Rb^{86}, Sb^{122}, and Au^{198} are determined, and are correlated with the nuclear properties. (T.F.H.)

34899 β-γ CORRELATION AS A FUNCTION OF E_β IN Ho^{166}. E. Creutz and L. Grenacs (Universite, Louvain, Belg.). Bull. Soc. Belge Phys., Ser. III, No. 2, 116(1962). (In French)

The correlation between the beta transition in Ho^{166} (end-point energy 1.77 Mev) and the ensuing gamma transition in the daughter Er^{166m} (energy 80 kev) is found to be consistent with an assignment of 0- to the ground state of Ho^{166} and 2+ to the 80-kev Er^{166m} state, if it is assumed that a perturbation factor G_2 is introduced as a result of the long lifetime of the intermediate 80-kev level in the cascade. A verification of the validity of the introduction of the perturbation factor is obtained by measuring the γ-γ correlation in the 1380 kev–80 kev cascade in Er^{166}, which cascade passes through the same intermediate state as the β-γ cascade under study. A value of G_2 of 0.29 is found for the γ-γ cascade, as compared with $G_2 = 0.28$ for the β-γ cascade. (T.F.H.)

34900 STUDY OF THE β-γ DIRECTIONAL CORRELATION IN Au^{198}. J. Lehmann and R. Gilles (Universite, Louvain, Belg.). Bull. Soc. Belge Phys., Ser. III, No. 2, 117-19(1962). (In French)

The directional correlation in the $2- \rightarrow 2+ \rightarrow 0+$ cascade between Au^{198} and the ground state of Hg^{198} is measured. The beta end-point energy is 963 kev and the gamma energy is 412 kev. The anisotropy of the directional correlation is measured as a function of beta energy, and it is found that as the beta energy decreases below 963 kev the anisotropy also steadily decreases, and does not begin to rise anomalously. (T.F.H.)

34901 FAST EJECTION OF PROTONS FROM THE CERN PROTON SYNCHROTON. CERN Courier, 3: 79-82 (June 1963). (In English)

The operation of the fast ejection system of the accelerator is explained. Information on the acceleration and use of the protons for experiments with internal or external targets is included. (D.C.W.)

34902 THE APPLICATION OF A TIME-DEPENDENT FORMALISM TO THE THEORY OF NUCLEAR REACTIONS. Joseph Lafoucrière and Edgard El-Baz. Compt. Rend., 257: 115-17(July 1, 1963). (In French)

The classical formalism of time-dependent scattering was applied to the study of nuclear reactions. The respective actions of evolution operators in the input and output tracks permit a simple interpretation of compound nuclei and direct interaction processes. (tr-auth)

34903 MEASUREMENTS OF CROSS SECTIONS OF (n,2n) REACTIONS PRODUCED BY NEUTRONS AT 14 Mev Claude Carles (Faculte des Sciences, Bordeaux). Compt. Rend., 257: 659-61(July 17, 1963). (In French)

The cross sections of (n,2n) reactions produced by 14-Mev neutrons on P^{31}, Fe^{54}, Ag^{107}, and Sb^{121} were measured by using an excitation method. The method consists in the coincidence detection of the two photons at 511 kev caused by the annihilation of the positrons emitted. The results are in very good agreement with the theory of evaporation. (tr-auth)

34904 THE γ RADIATION ASSOCIATED WITH THE TRANSMUTATION OF YTTERBIUM-166 INTO THULIUM-166. Pierre Paris and Francois David (CNRS, Orsay, France and Laboratoire Joliot-Curie de Physique Nucleaire, Orsay, France). Compt. Rend., 257: 662-3(July 17, 1963). (In French)

The only known transition in Tm^{166} was studied by β spectroscopy. It was interpreted as having a pure magnetic dipolar character. (tr-auth)

34905 THE RADIOACTIVITY INDUCED IN MATTER BY HIGH ENERGY PROTONS, NEUTRONS, AND PHOTONS. Marcel Barbier (CERN, Geneva). Ind. At., 7: No. 5-6, 55-65(1963). (In French)

All matter attacked by high-energy radiation becomes radioactive. The studies made at CERN to measure this induced radioactivity and to predict the doses received by personnel near radioactive objects are reviewed. (tr-auth)

34906 DISPERSION FORMULAS IN THE THEORY OF NUCLEAR EXCITATION. V. A. Dzhabashyan (Inst. of Physics, Erivan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz. Mat. Nauk, 16: 87-100(1963). (In Russian)

Calculations were made of nuclear reaction cross sections, neglecting Coulomb forces but considering resonances related to the production of intermediate nuclei and considering data presented by Adler and Bohr on proton excitation of Na^{23}. It is shown that, differential excitation cross sections as functions of scattering angle in purity Coulomb or interference and nuclear-resonance terms are described by Legrange polynomials. An analysis is made of elastic scattering of protons on Na^{23} and angular distribution of γ rays in $Na^{23}(p,\gamma)Mg^{24}$ at $E_p = 0.877$ Mev. Dispersion formulas for inelastic scattering in Coulomb fields are discussed in a supplement. (R.V.J.)

34907 DETERMINATION OF THE ISOTOPIC SHIFT OF MERCURY-196. C. Cassignol (CEN, Saclay, France). J. Phys., 24: 348-9(May 1963). (In French)

A magnetic-sweeping method is used to determine the isotopic shifts of mercury-196, -198, -200, and -202 in the resonance emission line at 2537 Å. The shifts ($\Delta\bar{\nu}$) are: 196 – 198; 0.138 cm^{-1}; 198 – 200, 0.161 cm^{-1}; and 200 – 202, 0.178 cm^{-1}. (T.F.H.)

34908 RECOIL-FREE RESONANT ABSORPTION OF 35.3-kev GAMMA RAYS OF Te^{125} AND HYPERFINE STRUCTURE OF ABSORPTION SPECTRUM. Naomoto Shikazono (Japan Atomic Energy Research Inst., Tokyo). J. Phys. Soc. Japan, 18: 925-35(July 1963).

With the source of Sb^{125} embedded in copper or iron metal, the recoil-free resonant absorption of 35.3-kev gamma rays by Te^{125} atoms in the crystals of tellurium, α-TeO_2, MnTe, and CrTe cooled with liquid nitrogen was studied. For the crystals of tellurium and α-TeO_2, large quadrupole splittings are observed. The values of $|e^2qQ| = 1.6 \times 10^{-6}$ ev, or $|e^2qQ/h| = 400$ Mc are obtained for both the crystals of tellurium and α-TeO_2, and the quadrupole moment of the first excited state of Te^{125} is estimated to be about 0.2 barn under some assumptions. For the crystal of MnTe and the source embedded in copper, a simple Lorentz line is observed and from the half width the half life of the 35.3-kev level of Te^{125} is calculated to be $(1.8 \pm 0.3) \times 10^{-9}$ sec. For the crystal of CrTe, line broadening

due to the internal magnetic field is observed. The internal field in the CrTe crystal is evaluated to be about 50 koersted. With the source embedded in iron metal, Zeeman splittings are observed, although they are poorly resolved. The magnetic moment of the first excited state of Te^{125} and the internal magnetic field at the Te nuclei in the iron environment are estimated to be about 0.7 n.m. and 600 koersteds respectively. (auth)

34909 PARAMAGNETIC RESONANCE FINE STRUCTURES OF OPTICALLY ALIGNED Cs^{133}, Rb^{87} AND Rb^{85} VAPOUR. Shigeru Ando (Mitsubishi Electric Mfg. Co., Japan). J. Phys. Soc. Japan, 18: 1095(July 1963).

The optical pumping principle, with the observation of the circularly polarized D_1 radiation that was transmitted through the vapor, was used to obtain the paramagnetic resonance fine structures of optically aligned Cs^{133}, Rb^{85}, and Rb^{87}. In Cs^{133} and Rb^{87} there are two peaks corresponding to F = 3,4 and 1,2 respectively. In Rb^{85} the peak seems to be an assembly of many peaks. In Cs^{133} the two peaks split into many peaks as the magnetic field increases to 8 gauss or more. The theoretical resonance fine structures calculated under the same conditions are also shown. (C.E.S.)

34910 PRODUCTION OF NUCLEAR ISOMERS FROM STABLE NUCLIDES WITH BREMSSTRAHLUNG. Tokishi Kaminishi and Chiyo Kojima (Government Industrial Research Inst., Nagoya, Japan). Japan J. Appl. Phys., 2: 399-405(July 1963).

For the application of photoexcitation process to activation analysis, a fundamental experiment was carried out. A number of stable elements were irradiated with bremsstrahlung from a 6-Mev linear electron accelerator. It was confirmed that the following isomers were directly produced from the stable nuclides with photons: Se-77m, Br-79m, Sr-87m, Y-89m, Rh-103m, Ag-107 + Ag-109m, Cd-111m, In-115m, Sn-117m, Ba-137m, Er-167m, Hf-179m, W-183m, Ir-191m, Pt-195m, Au-197m, and Hg-199m. Both In-113m and Ba-135m were not reliable and any isomers of even-even nuclides could not be observed in this experiment. In order to facilitate the measurement in practical use, especially for the isomers with half-life as short as several seconds, an automatic apparatus was designed and constructed. After a sample to be tested is transferred by an pneumatic conveyer to the irradiating position, the half life and the transition energies can be automatically measured with an appreciable accuracy. Details of the apparatus are described. Half lives of some short-lived isomers in question could be measured with the accuracy of 1–2% by using this apparatus with the overlap counting technique. (auth)

34911 CALCULATION OF THE SECONDARY ELECTRON SPECTRUM AT THE BOUNDARY LAYER. Naoko Shiomi and Takenobu Higashimura (Kyoto Univ.). Japan J. Appl. Phys., 2: 406-9(July 1963).

The slowing down spectrum of secondary electrons caused by gamma rays is analyzed by the segment theory in an infinite medium. An approximate method in a semi-infinite medium is shown for obtaining the spectrum of the electron crossing the boundary. A practical calculation is performed for the aluminum slab irradiated by Co^{60} gamma rays and the calculated spectrum of impinging electrons is compared with the experimental data with a sufficient consistency. (auth)

34912 INVESTIGATION OF THE MECHANISM OF (n,2n) REACTION IN LEAD AND BISMUTH. András Ádám, Péter Hraskó, Gabriella Pálla, and Pál Quittner. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen., 11: 185-96(1963). (In Hungarian)

An experimental investigation was made on the extent of the possible angular correlations between the neutrons produced in the (n,2n) reaction. The fast neutrons were detected by means of scintillation counters and fast coincidence circuits. From measurements on bismuth and lead the cross section of the (n,2n) reaction was found to be 20-30% lower than the values obtained by activation or any other method insensitive to the direction of the emerging neutrons thus suggesting a correlation between the neutrons. (auth)

34913 DECAY SCHEME OF THE Si^{28} NUCLEUS. Y. P. Antoufiev, L. M. El-Nadi, D. A. E. Darwish, O. E. Badawy, and P. V. Sorokin (Atomic Energy Establishment, Cairo). Nucl. Phys., 46: 1-24(July 1963). (In English)

Forty-five resonances in the $Al^{27}(p,\gamma)Si^{28}$ reaction were determined in the range of proton energy E_p from 0.9 to 2.5 Mev. Gamma-ray spectra for ten of these resonances at E_p = 0.992, 1.025, 1.184, 1.198, 1.212, 1.261, 1.316, 1.355, 1.514, and 1.589 Mev were studied and decay schemes for the corresponding resonance levels in the Si^{28} nucleus are proposed. The branching ratios for each level, and the resonance strengths for the transition to the first excited state were calculated. (auth)

34914 ELASTIC AND INELASTIC SCATTERING OF DEUTERONS ON SILICON AND SULFUR AT 11.8, 10.9, AND 10.0 Mev. W. Lorenz, C. Mayer-Boericke, R. Santo, and U. Schmidt-Rohr (Max-Planck-Institut für Kernphysik, Heidelberg). Nucl. Phys., 46: 25-32(July 1963). (In German)

Using the deflected beam of the cyclotron the energy dependence of the deuteron scattering from Si and S at 11.8, 10.9, and 10.0 Mev was studied. Angular distributions of the elastically and inelastically scattered deuterons (Si, Q = −1.78 Mev; S, Q = −2.24 Mev) were measured in 5° steps between Θ_{LAB} = 20 and 165°. The results were discussed in terms of Blair's diffraction scattering model. This model seems not to be directly applicable because different interaction radii for elastic and inelastic angular distributions were found. (auth)

34915 NUCLEAR ENERGY LEVELS OF Fe^{54} AND Fe^{56}. A. Aspinall, G. Brown, and S. E. Warren (Bradford Inst. of Tech., Yorkshire, Eng.). Nucl. Phys., 46: 33-44(July 1963). (In English)

Magnetic spectrometers were used to study the positions of energy levels in Fe^{54} and Fe^{56} excited in the (p,p′) reaction. One hundred and fifty levels below an excitation energy of 8.1 Mev were assigned to Fe^{54}, and forty levels below an excitation energy of 5.5 Mev were assigned to Fe^{56}. These and other available data on isotopes of iron are analyzed to investigate the variation of level density with neutron number near the closed neutron shell. Attention is drawn to the usefulness of magnetic spectrometers for the systematic study of changes in nuclear level densities. (auth)

34916 THE REACTION $Na^{23}(p,\alpha)Ne^{20}$ FROM 3 TO 12 Mev. K. L. Warsh, G. M. Temmer, and R. H. Blieden (Florida State Univ., Tallahassee). Nucl. Phys., 46: 45-50(July 1963). (In English)

The excitation curves for the ground-state and first-excited state alpha-particle groups from the reaction $Na^{23}(p,\alpha)Ne^{20}$ between 3 and 12 Mev proton energy were measured, as well as angular distributions for the ground-state and first three excited-state alpha transitions, at 10.0 Mev bombarding energy. Excited states of Ne^{20} up to the

tenth were observed, including two new ones at 5.80 and 7.02 Mev. (auth)

34917 (n,α) REACTIONS ON HEAVY NUCLEI WITH 14.7 Mev NEUTRONS. G. M. Marcazzan, F. Tonolini, and L. Zetta (CISE, Milan). Nucl. Phys., 46: 51-8(July 1963). (In English)

The energy spectra of α particles produced by the interaction of 14.7-Mev neutrons with Ho^{165}, Lu^{175}, Ta^{181}, and Au^{197} were studied by means of a solid state detector. The differential cross section was measured at an average angle of 30°. In the cases of tantalum and gold, the ratio between the α particle emission in the forward and backward directions were determined. (auth)

34918 DECAY OF In^{107} AND GAMMA SPECTRUM OF Cd^{107}. B. Basu and A. P. Patro (Saha Inst. of Nuclear Physics, Calcutta). Nucl. Phys., 46: 59-65(July 1963). (In English)

The decay of In^{107} was studied with scintillation spectrometers. The decay was found to occur by positron emission and electron capture. Altogether 10 gamma rays were assigned to Cd^{107}. The highest excited state of Cd^{107} was found to be at 2.86 Mev. There was only one positron group with end-energy 2.25 ± 0.15 Mev. On the basis of of sum spectrum, beta-gamma and gamma-gamma coincidences a tentative level scheme of Cd^{107} is suggested. (auth)

34919 POLARIZATION OF NEUTRONS SCATTERED FROM DEUTERONS. R. L. Walter and C. A. Kelsey (Univ. of Wisconsin, Madison). Nucl. Phys., 46: 66-72(July 1963). (TID-17549). (In English)

The polarization of neutrons scattered from deuterons was measured for several angles at neutron energies of 1.9, 6.0 10.0, 16.4, and 23.7 Mev. The polarization is less than 0.05 for neutron energies of 1.9 and 6.0 Mev and at 10.0 and 16.4 Mev polarizations of the order of 0.1 are observed. For a neutron energy of 23.7 Mev the polarization changes from −0.1 at 110° to +0.1 at 138° passing through zero polarization near 125°. (auth)

34920 THE (n,d) PICK-UP REACTION ON $f_{\frac{7}{2}}$ PROTON SHELL NUCLEI. L. Colli, E. Gadioli, S. Micheletti, and D. Lucioni (Università, Milan). Nucl. Phys. 46: 73-7(July 1963). (In English)

The angular distribution of deuterons from the reaction $Fe^{56}(n,d)Mn^{55}$ was measured for the l = 3 transition to the ground state of Mn^{55}. A good fit is found with DWBA calculations. A satisfactory agreement is also obtained between the experimental values of the cross section for the transition to the ground state of the final nucleus in a series of isotopes belonging to the $f_{\frac{7}{2}}$ proton shell and the theoretical values obtained from the shell model in the j-j coupling limit by means of DWBA calculations. (auth)

34921 DECAY OF ^{150}Eu. Yasukazu Yoshizawa (Osaka Univ.), Hideo Okamura, Shiro Iwata, Ichiro Fujiwara, Tsunenobu Shigematsu, Masayuki Tabushi, Tsunehiko Tarumoto, and Koh Sakamoto. Nucl. Phys., 46: 78-92 (July 1963). (In English)

Carrier free sources of Eu^{150} were prepared from bombardment of enriched Sm^{150} with 11-Mev deuterons and 9-Mev protons. The half life was determined to be 12.79 ± 0.08 h. The maximum energy of the negatons was 1.02 ± 0.01 Mev and the Kurie plot showed almost an allowed shape. However, the experimental shape factor showed a slight deviation from the allowed one. This decay was estimated to be 0^- or 1^- to 0^+ transition. Positrons with a maximum energy of 1.8 ± 0.3 Mev and an intensity of about 0.3% and the K x ray following orbital electron capture with an intensity of 3.9 ± 0.2% were found. In scintillation measurements 15 gamma rays were observed. Gamma-gamma conicidence studies were performed at several gate windows for gamma rays and annihilation radiations. The decay scheme of Eu^{150} was constructed on the basis of these results. (auth)

34922 THE $B^{11}(p,\alpha)Be^8$ REACTION AND C^{12} STATES BETWEEN 15 AND 20 Mev. G. D. Symons and P. B. Treacy (Australian National Univ., Canberra). Nucl. Phys., 46: 93-107(July 1963). (In English)

Detailed angular distributions were measured of α particles from the $B^{11}(p,\alpha)Be^8$ reaction for proton energies between 0.7 and 6.0 Mev. Previous spin and parity assignments of 0^+ and 2^+ for levels at 17.77 and 18.34 Mev in C^{12} are confirmed, and partial proton and α particle widths deduced for both levels. A level at 20.63 Mev, of width 275 kev, is assigned 3^-. The behavior of the cross section for proton energies below 2 Mev is discussed in terms of effects of levels below the proton threshold in C^{12}. (auth)

34923 PROPERTIES OF NUCLEAR ENERGY LEVELS IN Tm-169. Peter alexander and Felix Boehm (California Inst. of Tech., Pasadena). Nucl. Phys., 46: 108-18(July 1963). (In English)

The gamma-rays of Tm-169 excited through electron capture in Yb-169 were studied by use of a bent-crystal gamma-ray spectrometer. A source of high specific activity was produced from highly enriched Yb-168 by neutron capture. In addition to gamma rays previously reported gamma rays with energies of 117.25, 156.66, and 336.5 kev were observed. The 117.25-kev gamma ray probably is due to the depopulation of a $\frac{9}{2}^+(K = \frac{7}{2})$ state at 433.44 kev. The relative intensities of most of the gamma rays were measured to ±5%. Electron capture branching ratios to the various levels were derived. Branching ratios for transitions between different rotational bands were studied in detail. Most M1 and E2 interband branching ratio are in agreement with predictions based on recent formulas by Bohr and Mottelson while all E1 branching ratios differ from these predictions by an order of magnitude. (auth)

34924 ENERGY LEVELS OF Te^{125}. Girish Chandra and V. R. Pandharipande (Tata Inst. of Fundamental Research, Bombay). Nucl. Phys., 46: 119-27(July 1963). (In English)

The energy levels of Te^{125} were studied by detailed gamma-gamma coincidence measurements. Two new weak gamma transitions of energies 80 ± 5 and 120 ± 5 kev were observed in coincidence with the 176-kev gamma transition. A new energy level was introduced at 401 kev. There is evidence of a weak gamma transition of 62 kev between levels at 524 and 462 kev. (auth)

34925 DEPOSITION EFFICIENCY OF FISSION-FRAGMENT ENERGY. Meyer Steinberg (Brookhaven National Lab., Upton, N. Y.). Nucleonics, 21: No. 8, 151-3 (Aug. 1963).

Relations for determining from fission-fragment range data the fraction of total fission energy deposited (efficiency) when the kinetic energy of fission fragments is used to promote chemical reactions or to produce electricity (direct conversion) are examined. Fission fragment ranges in various materials are given, and the efficiencies of uranium oxide spheres in air, gas, and water are shown. (D.C.W.)

34926 EXCITATION OF NUCLEAR OCTUPOLES BY PROTON SCATTERING. G. R. Satchler, R. H. Bassel,

and R. M. Drisko (Oak Ridge National Lab., Tenn.). Phys. Letters, 5: 256-8(July 15, 1963). (In English)

The analysis of proton scattering in terms of direct interaction theory is a powerful tool for the study of a 3^- octupole-vibration state in nuclei through both experimental and theoretical predictions. Because angular distribution is sensitive not only to the multiple order of the transition but also to the radial distribution of the interaction in elastic scattering above the Coulomb barrier, greater detail can be used in testing the predictions of various nuclear models. (R.E.U.)

34927 SUM RULES AND HIGH-ENERGY PHOTONUCLEAR ABSORPTION. S. B. Gerasimov (Lebedev Inst. of Physics, Moscow). Phys. Letters, 5: 259-60(July 15, 1963). (In English)

Various sum rules are among the most important tools in treating photonuclear absorption. The asymptotic behavior of scattering amplitudes is widely discussed, and the question concerning the limits of the validity of the sum rules is put on the basis of dispersion relations and current assumptions concerning the high-energy cross section behavior. (R.E.U.)

34928 $Ca^{40}(n,\alpha_0)$ REACTION ENERGY SPECTRA AND DIFFERENTIAL CROSS SECTIONS. S. Cavallaro and A. Rubbino (Università, Catania, Italy). Phys. Letters, 5: 265-6(July 15, 1963). (In English)

Experiments were recently carried on using silicon junctions as target-detectors to measure the energy spectra of charged particles from (n,x) reactions in Si^{28} and Si^{29}. The maximum Q value for charged-particle emission in (n,x) reactions from silicon isotopes, contained in the detector, is -0.02 Mev for the $Si^{29}(n,\alpha_0)$ reaction. The $Ca^{40}(n,\alpha_0)$ reaction was investigated in order to extend the measurements for the energy spectra for the (n, charged particles) reaction. The Q value for the $Ca^{40}(n,\alpha_0)$ reaction is 1.75 Mev, which is in a region where the Coulomb barrier is not too high to prevent the alpha emission. The neutron source was a liquid-air-cooled D_2O ice target bombarded with deuterons accelerated by a Van de Graaff accelerator. (R.E.U.)

34929 POSSIBLE EXISTENCE OF A NUCLEAR MOLECULE OF A STRUCTURE $Li^6 + Li^8$. C. Lemeille, L. Marquez, and N. Saunier (CEN, Saclay, France). Phys. Letters, 5: 267-8(July 15, 1963). (In French)

34930 EXPERIMENTAL CONFIRMATION OF THE "DILLENBURG-MARIS"-PHENOMENON IN STATISTICALLY PERTURBED ANGULAR CORRELATIONS. E. Bodenstedt and C. Guenther (Universität, Bonn). Phys. Letters, 5: 268-9(July 15, 1963). (In English)

Recently it was pointed out by Dillenburg and Maris that the application of first-order perturbation theory in the treatment by Abragam and Pound might not generally be correct. Deviations might result in those cases where one single interaction is strong enough to cause a reasonable change in the spin state. Dillenburg and Maris used in their calculations only the assumptions that the perturbing interaction has statistical nature, random distribution in space, and invariance against time reversal and parity transformations. The 1380 kev−81 kev $\gamma\gamma$ cascade in the decay of 27-hr Ho^{166} was investigated for angular correlation. (R.E.U.)

34931 EXCITATION OF LEVELS IN Li^6 BY INELASTIC ELECTRON SCATTERING. M. Bernheim and G. R. Bishop (Ecole Normale Supérieure, Orsay, France). Phys. Letters, 5: 270-2(July 15, 1963). (In English)

Inelastic scattering of electrons from metallic targets of Li^6 was studied as part of a program to establish the validity of the Born approximation calculation of the cross section. This calculation predicts the separation of the inelastic form factor into two contributions corresponding to the absorption of longitudinal and transverse virtual photons by the bombarded system. (R.E.U.)

34932 LEVEL STRUCTURE OF Ca^{42}. C. Noack (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Letters, 5: 276-7(July 15, 1963). (In English)

Questions as to the β^+ decay of Sc^{42m} and the level structure of Ca^{42} as well as their theoretical interpretations are discussed, and experiments are suggested to settle some of these questions. (R.E.U.)

34933 THE INFLUENCE OF A THREE-BODY FORCE ON THE BINDING OF THREE NUCLEONS. B. Gruber (Dublin Inst. for Advanced Studies). Phys. Letters, 5: 278-9(July 15, 1963). (In English)

The behavior of a system of three particles in a three-body potential, derived by field-theoretical methods, is studied. Since from the two-body forces derived by field-theoretical methods saturation does not result, the nucleus would collapse under their influence. The nuclear saturation is explained by repulsive three-body forces which prevent this collapse in a three-body system. (R.E.U.)

34934 HIGH ENERGY TRANSITIONS IN O^{16}. H. P. Jolly, Jr. (Harvard Univ., Cambridge, Mass.). Phys. Letters, 5: 289-91(July 15, 1963). (In English)

Peaks in the inelastic electron scattering cross section for O^{16} at 44.5 and 49 Mev have recently been reported and suggested to be overtones of the E1 transitions of the giant resonance. It was concluded by comparing the observed form factors with those predicted by the surface interaction model that both E1 and E2 transitions were contributing to the observed peaks. The shell model was used to calculate the form factors for the lowest group of even-parity electric transitions, and it was found that these alone are sufficient to explain the observed cross sections without postulating E1 transitions at this energy. (R.E.U.)

34935 EXCITATION OF LEVELS IN Li^7 BY INELASTIC ELECTRON SCATTERING. M. Bernheim and G. R. Bishop (Ecole Normale Supérieure, Orsay, France). Phys. Letters, 5: 294-6(July 15, 1963). (In English)

Cross sections for the excitation of some levels in Li^7 up to 8-Mev excitation energy were measured by the inelastic scattering of electrons for a variety of incident electron energies and scattering angles. The cross section calculated in first Born approximation is expected to be valid for this nucleus. The calculated angular distribution is given for different spin and parity and for different levels of excitation. (R.E.U.)

34936 CIRCULAR POLARIZATION ANALYSIS OF NUCLEAR GAMMA-RAYS BY RESONANCE FLUORESCENCE. R. S. Raghavan (Purdue Univ., Lafayette, Ind.). Phys. Letters, 5: 297-8(Aug. 1, 1963). (In English)

A method for performing a beta-gamma circular polarization correlation experiment is proposed. This method can also be used for the determination of circular polarization of nuclear gamma rays. The gamma rays undergo Mössbauer absorption in an external absorber in which a magnetic field can be imposed parallel or antiparallel to the direction of the gamma ray. From the absorption properties of the medium, the difference in absorption for the two directions of the magnetic field gives the net circular polarization of the gamma ray in coincidence with the beta ray. (C.E.S.)

34937 RECOILLESS RESONANCE ABSORPTION IN Ru^{99}. O. C. Kistner, S. Monaro, and R. Segnan (Brookhaven National Lab., Upton, N. Y.). Phys. Letters, 5: 299 (Aug. 1, 1963). (BNL-7092). (In English)

Recoilless radiative emission and absorption were observed for the 90-kev transition in Ru^{99} resulting from the decay of Rh^{99}. The ground state spin and magnetic moment were measured as $^5/_2$ and -0.6, respectively. It is suggested that the spin of the 90-kev state is either $^1/_2$ or $^3/_2$. (C.E.S.)

34938 GROUND STATE SPIN OF Pr^{144}. R. Hess, P. Lipnik, and J. W. Sunier (Swiss Federal Inst. of Tech., Zurich). Phys. Letters, 5: 327-8(Aug. 1, 1963). (In English)

To clarify recent discrepancies on the spin of the Pr^{144} ground state, the β-γ circular polarization and directional correlations were measured. The coherence of the experimental values of the β spectra shape factor, the β-γ directional correlation, and the global properties of the Pr^{144} β decay makes it possible to assign definitely the spin 0^- to the ground state. (C.E.S.)

34939 THE SPINS OF Pr^{144} FROM β-γ CORRELATION MEASUREMENTS. W. Collin, H. Daniel, S. Margulies, O. Mehling, P. Schmidlin, H. Schmitt, and K. S. Subudhi (Max-Planck-Institut für Kernphysik, Heidelberg). Phys. Letters, 5: 329-31(Aug. 1, 1963). (In English)

The β-γ directional correlation measurements and circularly polarized correlation measurements using Compton forward scattering were used to determine the spins of the Pr^{144} energy levels. The results agree with the accepted assignment of 0^- for the Pr^{144} ground state. The decay scheme of Ce^{144}–Pr^{144} with the spin assignments of the various energy levels is illustrated. (C.E.S.)

34940 THE A-DEPENDENCE OF ELASTIC DEUTERON SCATTERING AT 11.8 Mev. T. Becker, U. Schmidt-Rohr, and E. Tielsch (Max-Planck-Institut für Kernphysik, Heidelberg). Phys. Letters, 5: 331-3(Aug. 1, 1963). (In English)

The angular distribution of elastically scattered deuterons on Ca, Se, Sr, Sb, Te, Ce, Sm, Ho, Pb^{206}, and Pb^{208} were measured for an incident energy of 11.8 Mev. Plots of the measured differential cross sections divided by the Rutherford cross section are illustrated. The diffraction pattern shows a smooth variation with atomic weight of the target nuclei and the maxima and minima shift to smaller angles with increasing atomic weight. (C.E.S.)

34941 POLARIZATION IN PROTON-He^4 SCATTERING AT INTERMEDIATE ENERGIES. M. K. Craddock (Rutherford High Energy Lab., Chilton, Berks, Eng.), R. C. Hanna, L. P. Robertson, and B. W. Davies. Phys. Letters, 5: 335-8(Aug. 1, 1963). (In English)

A proton beam with an intensity of 6×10^7 protons/sec and a maximum polarization of 36% was used to measure the polarization in p-He^4 elastic scattering at 22, 29, 40, and 48 Mev. Asymmetries were measured at four angles simultaneously using eight scintillation counters set in pairs at equal angles to the left and right of the target. The angular resolution functions, polarization curves, and polarization contour diagram are presented. (C.E.S.)

34942 SEARCH FOR UNUSUAL DECAY MODES OF THE HYPERNUCLEI. S. J. St. Lorant (Clarendon Lab., Oxford). Phys. Letters, 5: 343-4(Aug. 1, 1963). (In English)

Hyperfragments produced in meson (K^-) interactions in a nuclear emulsion were investigated. The decay modes, binding energies, recoil momenta, and Q values were presented for $_\Lambda H^4$, $_\Lambda He^4$, $_\Lambda He^5$, $_\Lambda He^7$, $_\Lambda Li^7$, $_\Lambda Li^8$, and $_\Lambda C^{14}$. (C.E.S.)

34943 LIFETIMES OF EXCITED STATES IN Al^{25} AND Al^{26}. N. H. Gale, N. Tubbs, N. Nath, and A. T. G. Ferguson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Letters, 5: 345-7(Aug. 1, 1963). (In English)

The lifetimes of the 450-kev level in Al^{25} and the 418-kev level in Al^{26} were investigated. The levels were populated in the $Mg^{24}(p,\gamma)$ and $Mg^{25}(p,\gamma)$ reactions, respectively. Prompt and delayed coincidence curves were used to obtain lifetimes of 3.25 ± 0.15 and 1.86 ± 0.09 ns for the Al^{25} 450-kev level and Al^{26} 418-kev level, respectively. (C.E.S.)

34944 AMBIGUITIES IN THE OPTICAL POTENTIAL FOR STRONGLY ABSORBED PROJECTILES. R. M. Drisko, G. R. Satchler, and R. H. Bassel (Oak Ridge National Lab., Tenn.). Phys. Letters, 5: 347-50(Aug. 1, 1963). (In English)

The origin of the discrete ambiguities that exist in the parameters of the optical model for 10 to 30 Mev deuteron scattering is explained, and it is pointed out that these ambiguities persist for other energies and other strongly absorbed projectiles such as He^3, He^4, and heavier ions. Optical model predictions for the scattering of 11.8-Mev deuterons from Zr and 43-Mev alpha particles from Ni^{58} are used as an illustration of the ambiguities. (C.E.S.)

34945 PHASE-SHIFT ANALYSIS OF p–He^4 ELASTIC SCATTERING AT AROUND 40 Mev. S. Suwa and A. Yokosawa (Argonne National Lab., Ill.). Phys. Letters, 5: 351-2(Aug. 1, 1963). (In English)

Inelastic parameters are introduced into the phase-shift analysis in an effort to simultaneously fit both the differential cross section data and the polarization data for the p–He^4 elastic scattering at 38.4 Mev. All waves up to the F-waves were taken into account. (C.E.S.)

34946 ON THE MECHANISM OF NUCLEAR SPIN RELAXATION. D. Dillenburg and Th. A. J. Maris (Universidade do Rio Grande do Sul, Pôrto Alegre, Brazil). Phys. Letters, 5: 357-8(Aug. 1, 1963). (In English)

The relaxation of the spin orientations of an assembly of nuclei by interactions that are statistical in time and random in space is considered. The relative importance of non-perturbative interactions in the mechanism of spin relaxation is also investigated. (C.E.S.)

34947 NEW Yb^{162} AND Tm^{162} ISOTOPES. A. Abdumalikov (Polytechnic Inst. of Tashkent, USSR), A. Abdurazakov, K. Gromov, Zh. Zhelev, N. Lebedev, B. Dzhelepov, and A. Kudryavtseva. Phys. Letters, 5: 359-61(Aug. 1, 1963). (In English)

The isotopes Yb^{162} and Tm^{162} produced in the spallation reaction on tantalum with a proton energy of 660 Mev were investigated. The decay scheme, conversion electron spectra, positron spectra, and half life of the isotopes were presented. (C.E.S.)

34948 NUCLEAR STRUCTURE STUDIES IN ISOTOPES OF NICKEL AND IRON. R. H. Fulmer and A. L. McCarthy (Univ. of Pittsburgh). Phys. Rev., 131: 2133-40(Sept. 1, 1963).

The levels of Fe^{55}, Fe^{59}, Ni^{62}, Ni^{63}, and Ni^{65} are studied with (d,p) reactions; angular distributions and absolute cross sections are analyzed with the aid of distorted-wave Born-approximation calculations. Essentially all levels in the odd isotopes up to about 1-Mev binding energy are assigned to a shell-model state, and their reduced widths are measured. From this, the "center of gravity" of each shell-model state is determined; the results for Fe^{55}, which has one neutron above a closed shell, are $p_{\frac{1}{2}} \gtrsim$

0.1 Mev, $f_{5/2}$ −1.4 Mev, $p_{1/2}$ ~ 3.2 Mev, $g_{9/2}$ −3.8 Mev, $d_{5/2}$ ~ 6.7 Mev, and $s_{1/2}$ ~ 7.3 Mev. The shell-model states in the Ni isotopes follow the same energy ordering except that the $f_{5/2}$ state decreases in energy to become the ground state of Ni^{65}, but the energy range of the spectra is compressed for greater neutron excess. The $p_{3/2}$, $f_{5/2}$, and $p_{1/2}$ states increase in "fullness" with increasing neutron excess, while the other states remain completely empty. The widths of the energy distributions of levels belonging to single shell-model states agree well with the predictions of the giant resonance theory of Lane, Thomas, and Wigner. (auth)

34949 INELASTIC ELECTRON SCATTERING FROM NUCLEI AND SINGLE-PARTICLE EXCITATIONS. Wieslaw Czyz (Stanford Univ., Calif.). Phys. Rev., 131: 2141-8(Sept. 1, 1963).

Arguments are presented that the single-particle excitations in nuclei induced by inelastically scattered electrons dominate the inelastic cross section in large domains of the momentum transfer (q) and the energy loss (ω). The sum rules for fixed q and ω are derived which include the transverse electron-nucleus interactions to order q^2/M^2 (M being the nucleon mass). The results of the calculations of the inelastic cross section for C^{12} at $\theta = 135°$ are discussed and compared with experimental data. (auth)

34950 LOW-ENERGY CHARGED-PARTICLE-INDUCED FISSION. Gregory R. Choppin, John R. Meriwether, and John D. Fox (Florida State Univ., Tallahassee). Phys. Rev., 131: 2149-52(Sept. 1, 1963).

The excitation functions for the proton and deuteron induced fission of Th^{232} and U^{238} were determined in the energy range of 3 to 12 Mev. The excitation functions were measured using direct counting with p,n junction counters, gross counting with a recoil catching technique, and radiochemical measurement of certain fission product nuclides. In addition, the ratio of the peak-to-valley values of the fission-fragment kinetic-energy spectrum were determined as a function of bombarding energy. Breaks in the ratio curve at certain bombarding energies are interpreted in terms of competition between fission and nucleon evaporation. (auth)

34951 PROPERTIES OF CAPTURE GAMMA-RAY SPECTRA OF s-WAVE AND p-WAVE RESONANCES IN Zr, Nb, AND Mo. H. E. Jackson (Argonne National Lab., Ill.). Phys. Rev., 131: 2153-62(Sept. 1, 1963).

The capture gamma-ray spectra of neutron resonances in Zr^{91}, Nb^{93}, and Mo^{95} have been studied in order to make unambiguous identification of individual resonances resulting from p-wave capture. Features of the capture spectra which are expected to be correlated with the parity of the capture state are discussed. For the nuclides studied, p-wave capture was detected by observing anomalously high intensities of transitions from the resonant state to a group of low-lying states of positive parity. For Mo^{96}, previous measurements have been extended to 1 kev and resonances at 108, 215, 330, and 1010 ev have been assigned negative parity. For Zr^{91}, the total intensity of transitions to the ten states with lowest energy in Zr^{92} has been measured for resonances in Zr^{91} below 2050 ev. The total intensities for the resonances at 247 and 448 ev, and at least one resonance at 2050 ev, are approximately 10 times that of the other resonances and have been assigned a negative parity. For Nb, the interpretation of the spectra is complicated by the presence of a 3^- state at 40 kev in Nb^{94}. However, for transitions to states within 700 kev of the ground state of Nb^{94}, resonances at 34, 42, 94, 244, and 524 ev have total intensities 5 times that of the remaining resonances and have been interpreted as p-wave resonances. From the assignments for Nb^{93}, a value of $(4.6^{+7.2}_{-1.6}) \times 10^{-4}$ was obtained for the neutron p-wave strength function. (auth)

34952 NUCLEAR SPECTROSCOPY OF Bi^{210} WITH STRIPPING REACTIONS. Paresh Mukherjee (Univ. of Pittsburgh). Phys. Rev., 131: 2162-8(Sept. 1, 1963).

Forty-four single neutron states are located in Bi^{210} with Bi^{209}(d,p) reactions. These are compared with the levels predicted from the j-j coupling shell model. Of the ten levels predicted from a coupling of the $h_{9/2}$ proton and the $g_{9/2}$ neutron, nine are observed including the ground state. One of them is assumed to be composed of two close-lying levels, thus, accounting for all the ten levels. Proton angular distributions and total cross section for exciting these ten levels suggest that they have a very pure $(h_{9/2})_p$ $(g_{9/2})_n$ configuration. A comparison of the relative cross sections for exciting these ten levels with the 2J + 1 statistical factor gives consistent spin values for these levels. Angular distributions of protons from several prominent groups in Bi^{209}(d,p) reactions are compared with those from Pb^{208}(d,p) reactions, identifying the $(d_{5/2})$, $(s_{1/2})$, and $(d_{3/2})$ neutron states in Bi^{210}. Effect of configuration mixing is discussed. The level density above 2.5-Mev excitation is found to be small compared to the shell-model prediction. (auth)

34953 MASS-ENERGY RELATIONS IN THE FISSION OF HIGHLY EXCITED HEAVY NUCLEI. Eldon L. Haines and Stanley G. Thompson (Univ. of California, Berkeley). Phys. Rev., 131: 2169-75(Sept. 1, 1963). (UCRL-10342 (Rev.))

Mass-energy relations in the fission of the compound nucleus Fm^{254} were studied at excitation energies in the range from 58 to 116 Mev. This compound nucleus was produced by bombardments of Th^{232}, U^{238}, and Pu^{242} with the heavy ions Ne^{22}, O^{16}, and C^{12}, respectively. The kinetic energies of the two fission fragments from each event were measured by using semiconductor detectors. From these energies the masses and total kinetic energies were calculated. The mass distributions were studied as a function of the total kinetic energy. The bell-shaped mass distributions narrowed rapidly as the kinetic energies of the fragments increased. The quantitative behavior of this narrowing suggests that most of the initial excitation energy of the compound nucleus is not available either for conversion into kinetic energy of the fragments or for the production of asymmetric mass divisions that are energetically unfavorable. (auth)

34954 ALPHA-DECAY PROPERTIES OF SOME ERBIUM ISOTOPES NEAR THE 82-NEUTRON CLOSED SHELL. Ronald D. Macfarlane and Roger D. Griffioen (Univ. of California, Berkeley). Phys. Rev., 131: 2176-81(Sept. 1, 1963).

New alpha-emitting isotopes of erbium, lying near the 82-neutron closed shell, were produced by $Nd^{142} + O^{16}$ bombardments at incident energies up to 151 Mev. The nuclides studied and their alpha-decay properties are

Nuclide	Q_α(Mev)	Half-life	Alpha branching ratio
Er^{152}	4.93 ± 0.02	10.7 ± 0.5 sec	$0.90^{+0.05}_{-0.20}$
Er^{153}	4.80 ± 0.02	36 ± 2 sec	$0.95^{+0.05}_{-0.20}$
Er^{154}	4.26 ± 0.02	4.5 ± 1.0 min	***

Alpha decay from erbium isotopes with A < 152 was not observed, indicating that the alpha-particle binding energies

of these isotopes are considerably higher than those for the 84-, 85-, and 86-neutron isotopes. Alpha reduced widths, calculated from the results for Er^{152} and Er^{153}, were found to be higher than the corresponding dysprosium, holmium, and terbium isotopes. Relative excitation functions were obtained for some $Nd^{142}(O^{18},xn)$ and $Nd^{142}(O^{18},pxn)$ reactions. (auth)

34955 ELECTROMAGNETIC PROPERTIES OF Li^7. J. H. van der Merwe (Univ. of the Witwatersrand, Johannesburg). Phys. Rev., 131: 2181-3(Sept. 1, 1963).

The energy level and magnetic data of Li^7 are more or less adequately explained by assuming an $(1p)^3$ configuration. However, there seems to be some discrepancy between the value for the quadrupole moment as predicted from this assumption and the measured value given by Kahalas and Nesbet. This discrepancy is explained in terms of a weak particle-surface coupling which need only affect the electric quadrupole operator. (auth)

34956 NUCLEAR STRUCTURE STUDIES IN THE ZIRCONIUM ISOTOPES WITH (d,p) AND (d,t) REACTIONS. Bernard L. Cohen and Oleg V. Chubinsky (Univ. of Pittsburgh). Phys. Rev., 131: 2184-92(Sept. 1, 1963).

Angular distributions from (d,p) reactions in the zirconium isotopes are found to agree exceedingly well with distorted-wave Born approximation calculations; this agreement includes the absolute cross sections. These reactions are used to assign all levels excited by (d,p) reactions in Zr^{90}, Zr^{91}, Zr^{92}, Zr^{94}, and Zr^{96} to single-particle (S.P.) states. The summed cross sections for each S. P. state in each isotope are close to expectations. The "centers of gravity" of each S. P. state are located; all of these including the nonpaired levels from the (d,p) reaction on Zr^{91}, behave very smoothly as a function of A. The summed cross sections for states of I = 0, 2, and 4 from Zr^{91}(d,p) each also agree with theory. The ground state of Zr^{92} is found to be 78% $(d_{5/2})^2$. Results from (d,t) reactions on the even isotopes leading to states other than $d_{5/2}$ behave very anomalously. Attempts to explain them are discussed but more data are needed. The Zr^{91}(d,t) reaction is used to obtain information on the ground state of Zr^{91}, and on the 3 − state of Zr^{90}. (auth)

34957 ANOMALOUS LINEWIDTH TRANSITION IN Na^{23}. F. J. Leech, L. C. Brown, and J. R. Gaines (Ohio State Univ., Columbus). Phys. Rev. Letters, 11: 121-2 (Aug. 1, 1963).

Pulsed and continuous-wave measurements of the nuclear magnetic resonance of Na^{23} are performed at 3 to 11 Mc, using dispersions of Na particles in mineral oil (particle size 1 to 15 micron). The line width of the NMR line rises sharply as the temperature increases above the melting point, and the spin-spin relaxation time is found to decrease as the temperature increases. (T.F.H.)

34958 TERNARY FISSION OF U^{235} INDUCED BY THERMAL NEUTRONS. M. Luis Muga (Univ. of Florida, Gainesville). Phys. Rev. Letters, 11: 129-31(Aug. 1, 1963).

Ternary fission events are studied in the thermal column of a reactor, using a $U^{235}F_4$ film and three coincidence detectors stationed 120° apart around this film (in a plane containing the film). It is demonstrated that the ternary count rate is caused by neither scattering nor accidental events. The distributions of total kinetic energy of the fission products, and of the masses of the fission products, are determined. Surface-barrier detectors are used, and the counting system has a 2 nsec resolution time. A lower limit of 1.2 ternary fissions per 10^6 binary fissions is indicated by the data. It is noted that the results are valid only at 120° spacing of the detectors. (T.F.H.)

34959 ELECTRON SCATTERING IN TRITIUM AND He^3. H. Collard (Stanford Univ., Calif.), R. Hofstadter, A. Johansson, R. Parks, M. Ryneveld, A. Walker, M. R. Yearian, R. B. Day, and R. T. Wagner. Phys. Rev. Letters, 11: 132-4(Aug. 1, 1963).

Distributions of electrons elastically scattered by He^3 and T are compared in order to analyze the three-body forces acting in these mirror nuclei. The charge and magnetic form factors for the nuclei are calculated. Three of these form factors are nearly equal to one another, but the charge form factor of He^3 is different from the other three. (T.F.H.)

34960 μ CAPTURE IN OXYGEN. R. C. Cohen, S. Devons, and A. D. Kanaris (Columbia Univ., New York). Phys. Rev. Letters, 11: 134-7(Aug. 1, 1963).

The capture rates of μ^- mesons by O^{16}, leading to the first four bound states of N^{16}, are measured. The ratio of capture to the 0^- and 1^- states of N^{16} is measured as: ratio $(0^-/1^-) = 0.38 \pm 0.07$. This result is consistent with an induced pseudoscalar coupling constant/induced axial vector coupling constant ratio of about 15 in the basic reaction $\mu^- + p \rightarrow n + \nu_\mu$. (T.F.H.)

34961 NUCLEAR SIZE CORRECTION TO THE RELATIVISTIC THOMAS FERMI EQUATION OF STATE AND ITS EFFECT ON CHANDRASEKHAR'S MASS LIMIT. Ashok Jain and V. K. Tewary (Univ. of Delhi). Progr. Theoret. Phys. (Kyoto), 29: 691-8(May 1963). (In English)

The relativistic Thomas Fermi model of a compressed atom was modified to account for the finite size of the nucleus. The equation of state of superdense matter based on the modified relativistic Thomas Fermi model was obtained and is found to have a mixed $\rho^{4/3}$ and $\rho^{5/3}$ density dependence of pressure. Correction to the electron pressure is about 10 percent at density 10^9 g cm^{-3} and increases to about 90 per cent at density 10^{12} g cm^{-3}. The mass limit calculated from the modified equation of state is about 2.5 times the unmodified value. (auth)

34962 ALPHA-CLUSTERING IN NUCLEAR MATTER AT LOW DENSITY. Minoru Harada, Ryozo Tamagaki, and Hajime Tanaka (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto), 29: 933-5(June 1963).

A gas of alpha particles is studied to get some idea of the mechanism of clustering in the surface region of heavy nuclei by considering this region to be represented by dilute nuclear matter. It is shown to be energetically more favorable for nucleons to cluster into alpha particles than to behave as single particles in a Fermi gas. The sparseness of nucleons in the surface region is the principal cause of cluster formation. (C.E.S.)

34963 ENERGY GAP IN NUCLEAR MATTER. Masaru Yasuno (Kobayashi Inst. of Physical Research, Kokubunji, Tokyo) and Takeshi Ishihara. Progr. Theoret. Phys. (Kyoto), 29: 940-2(June 1963).

In order to get definite information about the energy gap in nuclear matter with a realistic nuclear potential and to obtain insights into the energy gap of a real nucleus, the energy gap equation is solved by treatment of the hard core potential. It is suggested that the finiteness of a nucleus may play an important role for the observed energy gap of an actual nucleus. (C.E.S.)

34964 ENERGY GAP IN NUCLEAR MATTER. Hajime Tanaka and Ryozo Tamagaki (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto), 29: 942-4(June 1963).

An equation for the energy of the one particle mode and the energy gap of nuclear matter is directly solved in the momentum space for the realistic soft-core potentials without introducing ambiguities entering in the transformation to the configuration space. (C.E.S.)

34965 GAMMA-RAY TABLE. Eisaku Tajima. Radioisotopes (Tokyo), 12: 206-33(May 1963). (In Japanese)

34966 GAMMA SPECTRA OF NATURAL ELEMENTS IRRADIATED WITH PILE NEUTRONS. Minoru Okada. Radioisotopes (Tokyo), 12: 234-52(May 1963). (In Japanese)

34967 SCINTILLATION γ-RAY SPECTRUM FORMS RECORDED BY VARIOUS CONDITIONS. Masaharu Okano. Radioisotopes (Tokyo), 12: 261-5(May 1963). (In Japanese)

Gamma spectra of Na^{22}, Mn^{54}, Co^{60}, Cs^{137}, Zn^{65}, and I^{125} are shown. (L.T.W.)

34968 THE ELECTRON SCATTERING METHOD AND ITS APPLICATION TO THE STRUCTURE OF NUCLEI AND NUCLEONS. R. Hofstadter (Stanford Univ., Calif.). Rev. Univ. Nacl. Tucuman, Ser. A, 14: 299-324(1962). (In English)

A review is given of progress in the field of nucleon and nuclear structure using the method of high energy electron scattering. Quantum electrodynamics and Dirac theory is used to calculate the differential cross section for the electromagnetic or Coulomb interaction. Nuclear size, skin thickness, and charge distribution are discussed. Nucleon structure, form factors, and the mesonic clouds that appear in both the neutron and proton are also considered. Illustrative examples of the data obtained are presented. (C.E.S.)

34969 CONCERNING THE THEORY OF NON-SPHERICAL NUCLEI IN ACCORDANCE WITH THE INDEPENDENT PARTICLE MODEL. D. A. Zaikin. Tr. Fiz. Inst., Akad. Nauk SSSR, 14: 3-60(1962). (In Russian)

Level schemes were set up for spheroidal nuclei from the standpoint of the independent-particle model and the problem for nuclei which do not possess axial symmetry was considered. It was found that the derived level schemes agree with experimental data with respect to spins and parities of the ground states and low-lying isomeric states of odd-mass nuclei that are greatly deformed. This agreement is better than was found for the scheme derived by Gottfried. It also removes some of the deficiencies found in the Nilsson scheme. Both the present and the Nilsson schemes predict the low-lying isomeric states in W^{183} and Os^{189} to have the following spins: $11/2^+$ and $13/2^+$, respectively. Further consideration leads to the conclusion that the single-particle model in its simplest form allows a possible breakdown in axial symmetry in equilibrium nuclear shapes. This result attests to the advantage of taking into account the original proposal made by Davidov and Filipov. (TTT)

34970 INVESTIGATION OF THE REACTION $D(T,n)He^4$ BY THE METHOD OF THIN TARGETS IN THE ENERGY REGION FROM 40 TO 750 kev. L. N. Katsaurov. Tr. Fiz. Inst., Akad. Nauk SSSR, 14: 224-62(1962). (In Russian)

The energy dependence of the effective cross section was measured for the reaction $D(T,n)He^4$. Deuterons were accelerated and struck a thin target of titanium–tritium. The outgoing alpha particles were detected with a proportional counter. The cross section was measured for deuterons ranging from 48.1 to 733.6 kev. These results, together with those obtained from earlier measurements in this energy range, were compared with a curve calculated using the Breit-Wigner-Eisenbud formula. The formula was found to predict the cross section up to about 300 kev. From then on to higher energies the calculated numbers were found to be lower than the experimental data. The parameters that enter into the formula were derived from the results. The dependence of the value and position of the maximum in the cross section on these parameters was investigated. A significant dependence was noted for the parameters E_θ, a_1, and γ_1^2; little dependence was found for $\gamma_{\frac{1}{2}}^2$ and a_2. (TTT)

34971 DETERMINATION OF THE NUMBER OF SECONDARY NEUTRONS PRODUCED IN THE INELASTIC INTERACTION OF FAST NEUTRONS WITH HEAVY ATOMIC NUCLEI. V. V. Nefedov. Tr. Fiz. Inst., Akad. Nauk SSSR, 14: 263-95(1962). (In Russian)

The various methods for measuring the coefficient γ are discussed in connection with the use of a point source of fast neutrons. This coefficient (average number of secondary neutrons) was measured for 14-Mev neutrons in uranium (2.75 ± 0.15), lead (1.70 ± 0.07), copper (1.43 ± 0.03), iron (1.10 ± 0.08), and oxygen (0.81 ± 0.12). The coefficient was also measured for 2.5-Mev neutrons in uranium (1.13 ± 0.08). The (n,2n) cross section was determined for 14-Mev neutrons on iron (0.24 ± 0.12 barn) and lead (1.8 ± 0.2 barns). The (n,3n) cross section for 14-Mev neutrons on uranium was measured to be 0.17 barn. The inelastic scattering cross sections of 14-Mev neutrons on uranium, lead, copper, and iron are also reported and compared with cross sections calculated from the statistical theory. Attempts are made to present reasons for the disagreement found between the calculated values and the experimental results. (TTT)

34972 TWO NUCLEAR MODELS IN A STRONGLY DEFORMED REGION. Wu Li Hsueh Pao, 18: 605-8(Nov. 1962). (In Chinese)

34973 MÖSSBAUER ABSORPTION OF THE 77-kev γ RADIATION FROM Au^{197} IN METALLIC GOLD. H. J. Andrae, C. M. H. Hashmi, P. Kienle, and F. W. Stanek (Technische Hochschule, Munich). Z. Naturforsch., 18a: 687-9(June 1963). (In German)

With the help of the Mössbauer Effect, the nuclear resonance absorption of the 77-kev γ radiation of Au^{197} in metallic gold of various thicknesses was investigated. The line width was determined to be $(2.06 \pm 0.21) \times 10^{-7}$ ev; this corresponds to a half-width of $(2.2 \pm 0.3) \times 10^{-9}$ sec in agreement with direct measurements. In addition, an isomeric displacement was observed; the energy of the emission line (Au^{197} in Pt) was about $(3.04 \pm 0.05) \times 10^{-7}$ ev greater than that of the absorption line (Au^{197} in metallic gold). From absorption measurements at 80, 20.4, and 4.2°K, Debye temperatures for source and absorber were found to be 197 ± 16 and 171 ± 8°K, respectively. (tr-auth)

34974 EXCITATION FUNCTIONS FOR THE (d,p), (d,n), AND (d,2n) REACTIONS ON Ce^{142} TO 11.8 Mev. R. Bock and R. Ruedel (Max-Planck-Institut für Kernphysik, Heidelberg). Z. Physik, 174: 440-5(1963). (In German)

Total cross sections and excitation functions up to 11.8-Mev were measured for the Ce^{142}(d,p), (d,n), and (d,2n) reactions by the activation method. The cross sections found for E_d = 11.8 Mev are 187 mb, 54 mb, and 535 mb, respectively. By comparing these results with cross sections calculated from the statistical theory of nuclear reactions, it can be shown that the (d,p) reaction and nearly the whole (d,n) reaction proceed by a stripping mechanism. (auth)

34975 DIRECTIONAL CORRELATION FOR NUCLEAR RESONANCE FLUORESCENCE AND LIFETIME OF 412-kev LEVEL OF Hg^{198}. E. Friedland and H. R. Lemmer (Univ. of Pretoria). Z. Physik, 174: 507-10(1963). (In German)

Using the method of thermal Doppler-broadening of the emission line, the effective differential cross sections for nuclear resonance scattering for 412-kev photons by Hg^{198} were measured for well-defined scattering angles of 120 and 160°. The results indicated a partial mean lifetime for this energy level of $\tau_\gamma = (5.12 \pm 0.23) \times 10^{-11}$ sec. This result differed appreciably from the values reported by other workers. Possible reasons for these discrepancies are discussed. The ratio of the differential cross sections for resonance scattering at angles of 120 and 160° is consistent with a 0−2−0 transition. (auth)

34976 THE AVERAGE g-FACTOR OF THE FIRST-EXCITED ROTATIONAL STATE OF THE EVEN TUNGSTEN ISOTOPES IN NATURAL TUNGSTEN. A. Kleine-Tebbe and H. Spehl (Universität, Freiburg i. B.). Z. Physik, 174: 546-58(1963). (In German)

The average gyromagnetic ratio of the first excited 2^+ states of the tungsten isotopes was measured using a target of natural tungsten. An external magnetic field of 40950 ± 200 G was employed for observing the precession of the angular distribution of the 115-kev de-excitation γ rays following Coulomb excitation with an atomic hydrogen beam of 2.18 Mev. The measurement of the angular distribution was carried out with a proton beam at 6 different energies between 1.5 and 3.7 Mev, and was found to be slightly perturbed by internal fields. The measured attenuation coefficients are $G_2 = 0.966 \pm 0.049$, $G_4 = 1.07 \pm 0.15$. The gyromagnetic ratio was found to be $\bar{g} = 0.264^{+0.023}_{-0.019}$, in agreement with the average value of the measurements of Goldring and Vager and the average theoretical value of Nilsson and Prior, but lower than the measurements of Bodenstedt et al. (auth)

34977 PHOTOPRODUCTION OF POSITIVE PIONS ON HYDROGEN BETWEEN 200 AND 450 Mev. I. RANGE-TELESCOPE METHOD. C. Freitag, D. Freytag, K. Luebelsmeyer, and W. Paul (Universität, Bonn and Kernforschungsanlage, Julich, Ger.). Z. Physik, 175: 1-18(1963). (In English)

Range-telescope measurements of the photoproduction of mesons (π^+) on hydrogen between 200 and 450 Mev are presented. The photon beam was produced by the reactions of an electron beam with a tungsten target. Liquid hydrogen was used. The range telescope consisted of 5 plastic scintillators and one threshold Cherenkov counter. Before calculating the differential cross section, the measured counting rates were corrected for background, random coincidences, and for systematical effects on the counting rate connected with the telescope method. Results are presented in tabular form. (M.C.G.)

34978 PHOTOPRODUCTION OF POSITIVE PIONS ON HYDROGEN BETWEEN 200 AND 450 Mev. II. MAGNETIC SPECTROMETER METHOD. K. Althoff, H. Fisher, and W. Paul (Universität, Bonn and Kernforschungsanlage, Julich, Ger.). Z. Physik, 175: 19-33(1963). (In English)

Magnetic spectrometer measurements of the photoproduction of mesons (π^+) on hydrogen at 200 to 450 Mev are presented. For the bremsstrahlung production a rotating tungsten sheet was used as an internal target in the Bonn 500-Mev electron synchrotron. The differential cross sections were measured at meson (π^+) laboratory angles 30, 40, 60, 90, 120, 150, and 160°. Results are presented in tables and graphs. (M.C.G.)

34979 PHOTOPRODUCTION OF POSITIVE PIONS BETWEEN 200 AND 260 Mev AT FIXED MOMENTUM TRANSFER. K. Althoff (Universität, Bonn). Z. Physik, 175: 34-6(1963). (In English)

Using a magnetic spectrometer, the differential cross sections for the reaction $\gamma + p \rightarrow \pi^+ + n$ at photon energies between 200 and 260 Mev were measured. The kinetic variables were selected so that the transmitted meson impulse is the same as the value at the production threshold. (M.C.G.)

34980 CONTOUR MAP OF THE CROSS SECTION FOR PHOTO PRODUCTION OF PI-MESONS. G. Knop (Universität, Bonn). Z. Physik, 175: 37-9(1963). (In English)

The differential cross sections for the photoproduction of mesons (π^+) and mesons (π^0) are presented as a function of the production angle and the photon energy in the form of a contour map. This map is satisfactory for a comparison of experimental data with theory and allows the influence of the resonance and the pole terms to be explained. (M.C.G.)

34981 THE DECAY OF Er^{171} AND Er^{165}. Reinhard Schoeneberg (Universität, Göttingen, Ger.). Z. Physik, 175: 54-62(1963). (In German)

The γ spectrum of a neutron-activated probe of natural Er_2O_3 revealed an additional peak at 55 kev, which was attributed to the characteristic K x ray from the decay of Er^{165} by measurement of its half life in a NaI crystal. The activation cross section for thermal reactor neutrons for $Er^{164}(n,\gamma)Er^{165}$ was determined to be $\sigma_A = 20 \pm 7$ barn. The averaged conversion coefficient of the 111, 116, and 124 kev γ rays from $Er^{171} \rightarrow Tm^{171}$ was remeasured with scintillation counter equipment. (auth)

34982 SECOND ORDER EFFECTS IN THE HEAVY ION COULOMB EXCITATION OF Se^{76} AND Se^{78}. A. C. Douglas, W. Bygrave, D. Eccleshall, and M. J. L. Yates (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). 12p. (CONF-62-14)

From 3rd Conference on Reactions between Complex Nuclei, Asilomar, Calif., Apr. 1963.

The properties of the energy levels of Se^{76} and Se^{78} below 1.515 Mev are studied by Coulomb excitation, using O^{16} ions. Effects of reorientation on the cross sections for excitation of the first excited state of Fe^{56} by various ions (p, α, C^{12}, O^{16}, Ne^{20}, and Cl^{35}) are given graphically. (T.F.H.)

34983 GAMMA RAYS FROM NEUTRON CAPTURE IN $HELIUM^3$ AND DEUTERON CAPTURE IN DEUTERIUM. R. W. Zurmuhle (Univ. of Pennsylvania, Philadelphia); W. E. Stephens, and H. H. Staub. 11p. (CONF-46-54)

From American Physical Society Meeting, Washington, D. C., Apr. 1963.

Assuming the pulse-height and angular distribution of the 24-Mev gamma rays from the reaction $He^3(n,\gamma)He^4$, the differential and total cross sections were calculated. The cross sections are 5 μb/sterad and 4 μb, respectively. Gamma spectra of the $D(d,\gamma)He^4$ reaction taken at energies of 0.8, 1.35, and 2.25 Mev and at angles of 0, 45, and 90° indicate an upper limit for the differential cross section of 5×10^{-34} cm^2. (C.E.S.)

34984 THEORY OF CORRELATIONS AND FLUCTUATIONS IN NEUTRON DISTRIBUTIONS. R. K. Osborn and S. Yip (Univ. of Michigan, Ann Arbor). 10p. (CONF-39-11)

From American Nuclear Society Meeting, Salt Lake City, June 1963.

Equations are derived for the first and second order densities for neutrons and alpha particles. The implications

of the equations are examined by reducing them to their diffusion theory equivalents, and the one-speed equations are obtained. Results show that in cases where the singlet density can be approximated as spatially uniform, the same approximation may not apply to the doublet density. (D.C.W.)

34985 $Ti^{50}(d,p)Ti^{51}$ REACTION. P. D. Barnes (Yale Univ., New Haven), C. K. Bockelman, O. Hansen, A. Sperduto, and W. W. Buechner. 4p. (CONF-46-49)

From American Physical Society Meeting, Washington, D. C., Apr. 1963.

An analysis of the proton spectra from the $Ti^{50}(d,p)$ reaction at 6 Mev was presented. The protons were momentum analyzed at 24 angles. The differential cross sections for the formation of the Ti^{51} ground state and 2.133 Mev level are calculated. The energy level structure of Ti^{51} up to 5.2 Mev excitation is also presented. The experimental data were on slides and are not included. (C.E.S.)

34986 ON THE POSSIBILITY OF MASER ACTION BETWEEN NUCLEAR STATES. G. C. Baldwin, J. P. Neissel, J. H. Terhune, and Lewi Tonks (General Electric Co., Schenectady, N. Y.). 56p. (CONF-39-77)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

The possibility of a stimulated emission device, analogous to the laser, which can generate radiation at gamma-ray wavelengths is examined. Lacking reflectors, its operation would consist of multiplication during single passage of photon avalanches initiated by spontaneous emission. The required high concentration of excited states may be obtainable in many nuclides by radiochemical procedures. The maximum possible resonant cross section exceeds ordinary absorption by several orders of magnitude. Only a fraction of the resonant cross-section can be effective, because of line-broadening interactions with the nuclear environment. Singular effects in solids (optical branch excitation, localization of lattice disturbance, or Bragg-angle effects) are suggested that may allow operation at a recoil-displaced energy without population inversion, as alternatives to the Mössbauer effect. An experimental technique for directly measuring the stimulated-emission cross-section by detection of a coherent component in the total radiation is described in some detail. It is concluded that the question of gamma-maser feasibility can be conclusively answered only by experiment. (auth)

34987 THERMAL ACTIVATION TECHNIQUE FOR THE MEASUREMENT OF U-238 CADMIUM RATIOS. R. H. Lewis, T. C. Engelder, and D. B. Wehmeyer (Babcock and Wilcox Co., Lynchburg, Va.). 14p. (CONF-39-82)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

The thermal activation technique is an accurate method for measuring C_{28}-1 in tightly packed lattices (where C_{28} is near unity). The success of the technique depends upon the precision of weight-normalizing the processed uranium samples, the rapidity of chemical separation, and the accuracy in measuring the thermal activation ratios in the highly thermalized calibrating flux. Also, the basic technique should be equally successful for measuring C-1 for any reaction where the cadmium ratio is near unity. (auth)

34988 PHOTONEUTRON CROSS SECTION OF OXYGEN. K. N. Geller and E. G. Muirhead (Univ. of Pennsylvania, Philadelphia). 16p. (CONF-46-89)

From American Physical Society 1963 Spring Meeting, Washington, D. C., Apr. 1963.

The cross section of the reaction $O^{16}(\gamma,n)O^{15}$ is inferred from measurement of the residual radioactivity, at gamma energies of 15.5 to 23 Mev. Resonances are detailed. (T.F.H.)

34989 THE PHOTONUCLEAR-DISINTEGRATION DIPOLE SUM-RULE σ_0. Kenneth Hartt (Univ. of Missouri, Columbia). 5p. (CONF-22-26)

From American Physical Society, 1963 Annual Meeting, New York, Jan. 1963.

A method is given for formulating the bremsstrahlung-weighted dipole sum rule for photonuclear absorption, for the case N = Z, using isobaric spin notation. (T.F.H.)

34990 ELASTIC SCATTERING OF COMPLEX NUCLEI BY Pb^{208} AND Bi^{209}. S. D. Baker and J. A. McIntyre (Yale Univ., New Haven). 10p. (CONF-46-85)

From American Physical Society 1963 Spring Meeting, Washington, D. C., Apr. 1963.

The angular distributions of O^{16}, N^{14}, and C^{12} elastically scattered by Pb^{208} and O^{16} elastically scattered by Bi^{209} are measured at laboratory energies of about 10.5 Mev/nucleon. The ratio of the elastic scattering cross section with respect to the Rutherford scattering cross section is measured for each of these reactions as a function of the center-of-mass scattering angle, from about 15 to 40°. A theoretical analysis is carried out for these interactions, in which it is assumed that the nuclear phase shift and the outgoing partial wave amplitudes do not have sharp cutoffs, but change gradually as the scattering conditions change from total scattering to total absorption. (T.F.H.)

34991 β ACTIVITIES INDUCED BY PHOTON BOMBARDMENT OF LIGHT ELEMENTS. B. M. K. Nefkens (Purdue Univ., Lafayette, Ind.). 21p. (CONF-46-92)

From American Physical Society 1963 Spring Meeting, Washington, D. C., Apr. 1963.

Studies were made on β emitters produced by irradiation of Li, Be^9, B^{10}, C^{12}, N^{14}, and O^{16} with high energy bremsstrahlung. Measurements were made on the cross sections of the reactions $C^{12}(\gamma,\pi^-)N^{12}$ and $C^{12}(\gamma,\pi^+)B^{12}$ and on the comparative cross sections for (γ,p), $(\gamma,2p)$, and $(\gamma,2n)$ reactions. Activation curves for the sum of the β's produced with the various targets are illustrated. It is noted that the activation curves for (γ,p) reactions are close to an isochromat. (P.C.H.)

Particle Accelerators

Refer also to abstract 34171.

34992 (BNL-7148) COSMOTRON CURRENT MARKER. Vincent J. Kovarik (Brookhaven National Lab., Upton, N. Y.) N. Y.). June 19, 1963. Contract [AT(30-2)-Gen-16]. 10p.

Modifications consisted of redesigning the feedback loop and shielding the toroid to minimize capacitive pickup and of insulating the core from the magnet buss. A system analysis is presented, and system controls and operation are described. Operational properties of the redesigned loop and tests on the insulation between the grounded Faraday shield and the magnet buss and core are discussed. (D.C.W.)

34993 (CEAL-1004) SHIELDING MEASUREMENTS ON A 4-Gev PROTON BEAM. James K. DePagter and Mircea Fotino (Cambridge Electron Accelerator, Mass.). June 6, 1963. Contract [AT(30-1)-2076]. 27p.

Results are given for the angular and longitudinal distributions of radiation intensities transmitted through shielding walls in directions parallel and perpendicular to a collimated 4-Bev photon beam. The main exponential attenuation coefficients obtained for ilmenite-loaded concrete ($\rho = 4.0$) are: transverse (at $\theta = 70°$)–nucleonic shower: $\lambda = 2.1$/ft; longitudinal ($0 < 0 < 10°$)–nucleonic shower ($2 < t < 6$ ft) $\lambda_n = 1.5$/ft; muons ($t > 8$ ft) $\lambda_\mu = 0.35$/ft. Soft shower penetration: 6 ft. An attempt is made to analyze the nature of the transmitted radiation. (auth)

34994 (CEAL-1005) SEMI-ANNUAL REPORT FOR THE PERIOD JANUARY 1 TO JUNE 30, 1963. (Cambridge Electron Accelerator, Mass.). July 18, 1963. Contract AT(30-1)-2076. 16p.

The 6-Bev strong focusing electron synchrotron continued to operate well. Three-shift operation was begun, one shift being devoted to machine maintenance and improvement and two shifts being devoted to serving the various groups of experimentalists. Brief descriptions of the experiments are presented. New equipment was obtained, an external positron beam (10^6 particles/sec) was established, and preparations for trial production of an external electron beam were completed. (N.W.R.)

34995 (CERN-63-22) NUCLEAR EMULSION WORK USING THE CERN ACCELERATORS, DECEMBER 1959–APRIL 1963. J. C. Combe and W. O. Lock (European Organization for Nuclear Research, Geneva). June 12, 1963. 53p.

A brief account of each of the activities carried out by emulsion groups with the proton-synchrotron and the synchrocyclotron is given, and references to papers on the activities are included. Research on the handling, processing, and use of emulsions is treated similarly. (D.C.W.)

34996 (CERN-63-24) SOME REFLECTIONS ON FULL APERTURE KICKERS. H. Fischer (European Organization for Nuclear Research, Geneva). July 9, 1963. 16p.

Design and development of full aperture kickers for extraction of beams from strong-focusing synchrotrons are described. The kickers act as a delay line. They are designed presently to produce magnetic fields not higher than 500 gauss. (N.W.R.)

34997 (MURA-673) EFFECTS OF FIELD PERTURBATIONS IN FFAG ACCELERATORS. G. Parzen and P. L. Morton (Midwestern Universities Assn., Wis.). July 8, 1963. Contract AT(11-1)-384. 13p.

Because of the variation of the betatron oscillation frequencies, ν_z and ν_r, with the amplitude of the oscillation, it is difficult to avoid the resonances excited by perturbing fields. The range of tunes, ν_r and ν_z, covered by a beam, which includes the useful range of oscillation amplitudes, will contain a large number of perturbation resonances which will affect the betatron oscillations of the particles. The rapid variation of tune with amplitude seems, however, to limit the effect of the perturbation resonances. Detailed results are given for the effects of the nearest linear coupling resonance, which is $\nu_r + \nu_z = 16$ for the accelerator considered, and which will be one of the stronger resonances excited by the perturbing magnetic field. (auth)

34998 (NP-13002) FIFTH ANNUAL REPORT FOR THE PERIOD OCTOBER 1, 1961 TO SEPTEMBER 30, 1962 [ON NUCLEAR SCIENCE]. (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Chilton, Berks, England). 22p.

The fifth annual report of the Rutherford High Energy Laboratory contains information on objects of the laboratory, finances, membership, administrative matters, proton linear accelerator, nuclear equipment and research programs for Nimrod synchrotron, other accelerator projects, research reactors, radiochemical laboratory, Atlas computer laboratory, and electron laboratory. (N.W.R.)

34999 (NP-13064) SYMPOSIUM ON BETATRON CONSTRUCTION AND UTILIZATION, BUCHAREST, NOVEMBER 1962. ABSTRACTS OF THE PAPERS. (Academia R.P.R. Institutul de Fizică Atomică, Bucharest). 18p. (In English, German, and Russian.)

Research on photonuclear absorption of 15 to 35-Mev gammas in light elements, properties of the betatron, interactions in the betatron, gamma reactions, and production and decay of mirror nuclei is reviewed. (D.C.W.)

35000 (SLAC-10) TWO-MILE ACCELERATOR PROJECT. Quarterly Status Report, October 1 to December 30, 1962. (Stanford Univ., Calif. Stanford Linear Accelerator Center). Mar. 1963. Contract AT(04-3)-400. 86p.

Research progress on accelerator structures, klystrons, high-power klystron windows, injection systems, beam dynamics, modulators, control systems, and microwave systems is reported. Developments in the research, mechanical engineering, and plant engineering divisions are also included. (D.C.W.)

35001 (UCRL-10807) I. THE THEORY OF ABERRATIONS OF QUADRUPOLE FOCUSING ARRAYS. II. ION OPTICAL DESIGN OF HIGH QUALITY EXTRACTED SYNCHROTRON BEAMS WITH APPLICATION TO THE BEVATRON (thesis). Philip Francis Meads, Jr. (California. Univ., Berkeley. Lawrence Radiation Lab.). May 15, 1963. Contract W-7405-eng-48. 312p.

The problem of analyzing and evaluating the aberrations of quadrupole magnet beam systems, and of characterizing the shapes and other properties of the beam envelopes in the neighborhood of foci is formulated. All aberrations, including those due to misalignments and faulty construction, through third order in small parameters, for quadrupole beam systems are considered. Analytic and numerical techniques for treating these aberrations, yielding useful expressions for the comparison of the aberrations of different beam systems, are developed as well as a comprehensive digital computer program that determines the magnitude and nature of the aberrations of such beam systems. The aberrations of two typical beam systems are analyzed numerically. The extraction of the proton beam from a synchrotron of "H" type magnet construction is also treated. Optical studies that resulted in the design of an external beam from the Bevatron that is optimized with respect to linear, dispersive, and aberration properties and that uses beam elements of conservative design are described. The digital computer programs developed to carry out detailed orbit studies that were required because of the existence of large second order aberrations in the beam are discussed. (auth)

35002 (UCRL-10900) PHASE LOCK OF CAVITIES. Edward C. Hartwig and Allen Sherwood (California. Univ., Berkeley. Lawrence Radiation Lab.). July 9, 1963. Contract W-7405-eng-48. 8p. (CONF-114-5)

From Proceedings of the International Conference on High Energy Accelerators, Dubna, Aug. 1963.

The transmission line properties required to minimize the phase shift between accelerator cavities connected by transmission lines are mathematically analyzed by treating the cavities as lumped circuits. Making the load conductance small reduces the phase shift caused by detuning and lowers the maximum voltage that occurs on the line when the cavity is detuned. (D.C.W.)

35003 ORC ELECTRON LINEAR ACCELERATOR. [PART] I. Shigeru Okabe, Kunihiko Tsumori, Tatsuo Tabata, Keisuke Kawabata, Kyue Fukuda, Rinsuke Ito, Shigeki Nakamura, Toshio Azuma, and Kiichi Kimura. Ann. Rept. Radiation Center Osaka Prefect., 3: 47-53 (1962). (In English)

The performance of the Osaka Radiation Center (ORC) linear accelerator is reported from a point of view of the relation between operating conditions and characteristics of the electron beam. The linac produces intense electron beams in the energy range 3 to 15 Mev, which can be converted into x rays or neutrons. Relations between electron energy, energy spectrum, and beam current are discussed. (P.C.H.)

35004 ORC ELECTRON LINEAR ACCELERATOR. [PART] II. Shigeru Okabe, Kunihiko Tsumori, Kyue Fukuda, Tatsuo Tabata, Keisuke Kawabata, Rinsuke Ito, Shigeki Nakamura, Toshio Azuma, and Kiichi Kimura. Ann. Rept. Radiation Center Osaka Prefect., 3: 54-7(1962). (In English)

The Osaka Radiation Center linear accelerator produces intense electron beams in the energy range 3 to 15 Mev, which can be converted into x rays or neutrons. Descriptions of the electrons beams, x rays, and photoneutrons are given. Pulsed radiation doses as high as 10^8 r/sec are produced. (P.C.H.)

35005 SHORT PULSING FOR LINAC. [PART] I. Shigeru Okabe, Keisuke Kawabata, and Kunihiko Tsumori. Ann. Rept. Radiation Center Osaka Prefect., 3: 60-2(1962). (In English)

Methods of getting a short beam pulse with a linear accelerator are reviewed, and details of a method to be tried on the Osaka Radiation Center accelerator are described. (P.C.H.)

35006 RADIOISOTOPE PRODUCTION BY ORC LINAC. J. Furuta, M. Fujishiro, T. Onishi, and T. Azuma. Ann. Rept. Radiation Center Osaka Prefect., 3: 78-81(1962). (In English)

Conditions for the production of K^{42}, Mn^{56}, As^{76}, Cs^{134}, La^{140}, Yb^{169}, Yb^{175}, Er^{163}, Er^{171}, Hf^{175}, and Hf^{181} by the Osaka Radiation Center linear accelerator are given. Properties and half lives of the radioisotopes are also given. (P.C.H.)

35007 ALTERNATING FOCUSING BY CROSSED GRADIENT FIELDS IN A LINEAR ACCELERATOR. Pierre Lapostolle and Francis Fer (CERN, Orsay, France). Compt. Rend., 256: 5294-7(June 17, 1963). (In French)

It can be shown in a very general manner that the incompatibility between phase stability and transverse stability exists only in the case where the configuration of the electric field lines are repeated identically from one accelerator stage to the other. This generalization is limited to the consideration of a linear accelerator of the Sloan-Lawrence type. The conditions for phase and transverse stability are derived. (J.S.R.)

35008 EXPERIMENTAL STUDY OF THE ENERGY SPECTRUM OF A "SLOAN AND LAWRENCE" ACCELERATOR FOR HEAVY IONS. Daniel Boussard (Institut d'Électronique, Orsay, France). Compt. Rend., 257: 96-9 (July 1, 1963). (In French)

The "Sloan and Lawrence" type accelerator is under detailed study in order to test and compare various focusing devices. This structure contains drift tubes connected in series to line terminals or to terminals of a resonating circuit. It is used for the acceleration of heavy ions at relatively low energy. A low-power prototype of such a device of the classical type was constructed. It has no focusing device, and the first results obtained on the energy spectrum are presented. (tr-auth)

35009 ETL 25 Mev BETATRON. I. MAGNET. Takio Tomimasu. Denki Shikensho Iho, 27: 127-34(Feb. 1963). (In Japanese)

An ETL 25-Mev betatron was designed and constructed as a standard source of high energy x-rays and electrons and was operated with success. Formulas that represent relations among factors for economical design of a betatron magnet, such as the energy of electron, equilibrium orbit, weight of magnet, cross section of accelerating tube, ampere-turns, capacity of resonant condenser, kind of silicon steel sheet and price of construction, a general principle in designing a betatron magnet, and the structure of the magnet and its energizing system are presented. Main constants of the magnet are as follows: the total weight of the manget and coils, 3 tons; the radius of equilibrium orbit, 17.8 cm; the total capacitor storage under full power, 910 kva; and the air gap between the pole pieces at r_0 = 17.8 cm, 7.8 cm. (auth)

35010 THE DETERMINATION OF THE POLE SHOE FORM AND THE EXPERIMENTAL VERIFICATION OF THE FIELD EXPONENTS IN THE BETATRON (SYNCHROTRON) AND ON MODELS. Constantin Iliescu, Stefan Haltrich, and Julian Leibovici (Inst. of Atomic Physics, Bucharest). Exptl. Tech. Physik, 11: 130-44(1963). (In German)

On the basis of general theoretical considerations and from the use of a concrete example, the calculation and the verification of the pole shoe form for cylindrical accelerators such as the betatron or synchrotron were investigated. The example shows that one can frequently avoid methods which necessitate much time expenditure (relaxation methods), and simple plane models can be consulted both in electrolytic model studies and in the construction of magnetic models. A possibility for the improvement of the accuracy of the electrolytic model studies was described. The pattern of the field exponent in the median plane, which was obtained in the case of the betatron of the Institut für Atomphysik in two different ways (by investigations on the electrolyte tank and by magnetic measurements), is within the limits of error. (tr-auth)

35011 VOLTAGE PROGRAMMING OF RADIO FREQUENCY ACCELERATIONS IN AN ALTERNATING GRADIENT PROTON SYNCHROTRON. Kazuo Huke and Giiti Iwata (Tokyo Univ.). Japan J. Appl. Phys., 2: 394-8(July 1963).

The condition that r-f buckets of radio frequency accelerations in synchrotrons always have no empty space by virtue of the adiabatic damping of phase oscillations, is obtained by calculating the action integral of phase oscillations. This analysis is applied to make r-f voltage programming which minimizes the maximum r-f voltage and r-f powers for the 12 Bev AG proton synchrotron of a high repetition rate. The behaviors of phase oscillations in the neighborhood of the transition energy in this scheme of r-f accelerations are also analyzed and discussed. (auth)

35012 BROADENING OF CHARGED PARTICLE BEAM. I. M. Kapchinskii. Radiotekhn. i Elektron., 8: 985-90(June 1963). (In Russian)

A formula was developed for self consistent Coulomb fields of drifting beams. Calculations are given for beam broadening in the drift space, considering simultaneously the space charge and disordered dispersion of particle thermal velocities. (tr-auth)

35013 STORAGE RINGS. Gerard K. O'Neill (Princeton Univ., N. J.). Science, 141: 679-86(Aug. 23, 1963).

Data on existing and proposed particle accelerators are reviewed. The possibility is discussed of using extra guide fields, or electron storage rings, to increase the energies of particles produced by existing accelerators. Results of beam storage and beam stacking experiments are reported. (C.H.)

35014 TEORIYA TSIKLICHESKIKH USKORITELEI. (Theory of Cyclotrons). A. A. Kolomenskii and A. N Lebedev. Moscow, State Publishing House of Physico-Mathematical Literature, 1962. 352p.

Descriptions are given of the theory and construction of various types of cyclotrons. Operational problems, parameter calculations, maximum energies, and intensity of accelerated particles are discussed. Strong-focusing accelerators, radiation effects, and particle accumulation problems are analyzed in detail. The boon was designed for engineers and personnel working with high-energy particles and accelerator techniques, as well as for graduate students. 196 references are included. (R.V.J.)

35015 ELEKTROSTATICHESKIE USKORITELI ZARYAZHENNYKH CHASTITS. (Electrostatic Accelerators of Charged Particles). A. K. Val'ter, F. G. Zheleznikov, I. F. Malyshev, G. Ya. Roshal, A. N. Serbinov, A. A. Tsygikalo, and S. P. Tsytko. Moscow, Gosatomizdat, 1963. 302p.

A review is given of the design, development, and performance of electrostatic accelerators; charged particle sources; methods of measurement; and stabilization of acceleration. Also, descriptions are given of accelerators constructed and used in the USSR. (R.V.J.)

35016 ION SOURCE DEVELOPMENT (Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE-1016)

This package contains 42 drawings. The ion sources were developed for Van de Graaff accelerators; however, the sources also are applicable to Cockcroft-Walton accelerators. All of the equipment included in CAPE-736, Duo-Plasmatron Ion Source, was improved and the drawings for this modified equipment are included. They include the following sources: duo plasmatron ion source, duo plasmatron ion source Model II, duo plasmatron ion source Model III, duo plasmatron ion source Model IV, duo plasmatron ion source Model VI, duo plasmatron ion source Model VII, heavy ion PIG source Model I, heavy ion PIG source Model II, and RF Ion Source. The drawings of auxiliary equipment used with the ion sources also are included. (F.E.S.)

35017 TANDEM VAN DE GRAAFF ACCELERATOR, 12 Mev (Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE-1027)

This package contains 20 drawings. The 12-Mev Tanden Van de Graaff accelerator was completed in 1962. Proton beams of various energies up to 12 Mev; nitrogen–ion beams of 30 Mev; and oxygen–ion beams as high as 42 Mev were produced. Energy resolution of these beams was better than 0.1%. These higher-energy beams were made possible by the "charge-exchange" mechanism employed to achieve double acceleration. Singly charged negative ions were injected and accelerated to the positive terminal of the accelerator where they encountered a higher-density oxygen gas region. The high velocity negative ions lost electrons to neutral gas molecules and became positive ions which were further accelerated from the terminal to the ground potential. Included are the following auxiliaries used with the tandem Van de Graaff Accelerator: cable trough for rack cabinets; hatchway platform; magnet leveling device; analyzing magnet chambers, $28\frac{1}{2}$ in. and 34 in. in radii; actuator drive unit; pneumatic beam-viewer cup; and a faraday beam cup for the actuator. (F.E.S.)

Plasma Physics and Thermonuclear Processes

Refer also to abstracts 33439 and 33440.

35018 (AD-411849) RADIATION FROM A UNIFORMLY MOVING DISTRIBUTION OF ELECTRIC CHARGE IN AN ANISOTROPIC, COMPRESSIBLE PLASMA. Technical Report No. 410. H. S. Tuan and S. R. Seshadri (Harvard Univ., Cambridge, Mass. Cruft Lab.). May 2, 1963. Contract Nonr-1866(32). 25p.

The radiation characteristics of a linear distribution of electric charge moving with a uniform velocity in a homogeneous electron plasma of infinite extent are investigated for the case in which a uniform static magnetic field is impressed externally throughout the medium. The linear distribution of charge and its direction of motion are assumed to be parallel and perpendicular, respectively, to the direction of the external magnetic field. Of the two possible modes of waves of small amplitude, namely, the modified electromagnetic mode and the modified plasma mode, the uniformly moving charge distribution excites the modified plasma mode. The emitted radiation has no frequencies less than the plasma frequency. For a particular value of the ratio of the gyrotropic to the plasma frequency of the electrons, the frequency and the angular spectrum of the emitted radiation are determined for two values of the velocity of the charge. (auth)

35019 (AD-411955) ATOMIC PROCESSES IN HELIUM–KRYPTON AND HELIUM–XENON MIXTURES. Report R-171. C. L. Chen (Illinois. Univ., Urbana. Coordinated Science Lab.). June 1963. Contract DA-36-039-TR US AMC 02208(E). 34p.

The momentum transfer collision frequency of thermal electrons with neutrals in a decaying plasma established in helium–krypton and helium–xenon mixtures of known proportions were measured by microwave interferometer at gas temperatures of ~200 to 600°K. The energy dependences of the momentum transfer cross sections of electrons with krypton and xenon atoms deduced from these measurements are best represented by: $Q_m(u) = 6.56 \times 10^{-15} - 2.79 \times 10^{-14}\, u^{1/2} + 3.14 \times 10^{-14}$ and $1.91 \times 10^{-14} - 8.30 \times 10^{-14}\, u^{1/2} + 9.40 \times 10^{-14}\, u\ cm^2$, respectively. Here u is the electron energy in electron volts. Mobilities of Kr^+ and Xe^+ in helium and in their respective parent gas were also determined, from the characteristic time constants of the electron density decay measured in the afterglow in the mixtures at low pressures, to be: $\mu(Kr^+$ in He) = 2.02 ± 1.2 cm^2/volt-sec, $\mu(Kr^+$ in Kr) = 1.01 ± 0.06, $\mu(Xe^+$ in He) = 18 ± 1.1 and $\mu(Xe^+$ in Xe) = 0.55 ± 0.03 at ~300°K. A study of the pressure dependence of the characteristic time constants of the electron density decay at fixed ratios of krypton to helium and xenon to helium concentrations yields the three body conversion frequency of atomic krypton and xenon ions to their respective molecular ions. (auth)

35020 (AD-412253) RADIATION DUE TO THE RADIAL MOTION OF A CONDUCTING SPHERE IN A MAGNETIC FIELD. Report No. 85-25. Giulio Venezian (California Inst. of Tech., Pasadena). June 1963. Contract Nonr-220(28). 54p.

The electromagnetic fields resulting from the radial motion of a perfectly conducting sphere in a uniform magnetic field are studied. Expressions for the radiated power are obtained for the cases of a sphere expanding or contracting at a uniform rate, for a sphere oscillating between two radii at a uniform speed, and for a sphere undergoing small amplitude oscillations. The effects of finite amplitudes are examined. (auth)

35021 (CLM-R-28) STABILIZED PINCH EXPERIMENT. H. S. Cockroft, A. Malein, and P. A. Shatford (United Kingdom Atomic Energy Authority. Research Group. Culham Lab., Culham, Abingdon, Berks, England). Sept. 1962. 25p.

Experiments on a long linear pinched discharge are described. Under all conditions the current skin separating the axial and azimuthal magnetic fields is found to be relatively diffuse. The observed instability growth rates correspond more closely to the theoretical values for a fully diffuse pinch than to those for a sharp ("stabilized") pinch. The rate of diffusion of magnetic field is the greater the lower the initial filling pressure, a result qualitatively in agreement with the measurements on Zeta in the so-called "anomalous resistivity" regime. (auth)

35022 (CONF-46-87) DIRECT MEASUREMENT OF IONIC SOUND WAVE VELOCITY. I. Alexeff and W. D. Jones (Oak Ridge National Lab., Tenn.). [1963]. Contract [W-7405-eng-26]. 11p.

From American Physical Society 1963 Spring Meeting, Washington, D. C., Apr. 1963.

The velocity of ionic sound waves in a plasma was measured directly by a time-of-flight technique. The plasma was contained in a simple glass discharge tube. Plasmas were formed from H_2, He, Ne, A, Kr, and Xe. The measured velocity agrees well with the velocity computed by Tonks and Langmuir, $v = (\gamma k T_e)^{1/2} m_i^{-1/2}$. The electron temperature, T_e, was measured by a Langmuir probe. Preliminary data suggest that of the three possible permitted values of γ (1, $^5/_3$, 3), the value $\gamma = 1$ does not occur. (auth)

35023 (CONF-78-6) IMPURITY RADIATION FROM NON-MAXWELLIAN SPHERICAL PLASMAS. S. Cuperman (Oak Ridge National Lab., Tenn.). Contract [W-7405-eng-26]. 27p.

From American Physical Society 1963 Summer Meeting, Buffalo, June 1963.

The influence of non-maxwellian free electron energy distributions on the steady state de-excitation radiation of not completely stripped impurity ions persisting in homogeneous spherical plasmas is investigated. Following an astrophysical method due to R. N. Thomas, the equation of radiative transfer and that giving the rate of change of the impurity atomic populations, taking into account all radiative and collisional processes involved, are simultaneously solved for arbitrary free electron distributions. As a result, the simple energy loss formula for a two-level impurity atom, calculated without the assumption of Boltzmann atomic distributions, but using maxwellian distributions for free electrons, is rewritten to be valid for arbitrary free electron energy distributions. The possibility of using the corrected formula for spectroscopic purposes is discussed. Numerical examples that emphasize the importance of the correction introduced are presented. (auth)

35024 (MATT-151) SOME COMPUTER EXPERIMENTS WITH A ONE-DIMENSIONAL PLASMA MODEL. Craig Smith and John Dawson (Princeton Univ., N. J. Plasma Physics Lab.). Jan. 1963. Contract AT(30-1)-1238. 177p.

The instability that results from the passage of a current through a plasma was numerically investigated by following with a computer the exact one-dimensional trajectories of a system of charge sheets. The model, kinetic equations, drift instabilities, and the results are discussed. Experiments for high and low current cases with other conditions equal gave quite opposite results. One particularly interesting result was anomalous electrical resistance in the high-current case. Particulars are given. (D.C.W.)

35025 (MATT-180) THEORY OF SPHERICAL ELECTROSTATIC PROBES IN A SLIGHTLY IONIZED, COLLISION-DOMINATED GAS— REVIEW AND EXTENSION. Ira M. Cohen (Princeton Univ., N. J. Plasma Physics Lab.). Mar. 1963. Contract AT(30-1)-1238. 108p.

The diffusion equations describing the motion of ions and electrons are derived from the Boltzmann equation and applied to the problem of a spherical electrostatic probe in a dense, slightly ionized gas. The production of charged particles, time variation and magnetic field are all neglected. The asymptotic limits $\rho_p = r_p/\lambda_d \to \infty$ and $\tau = T_-/T_+ \to \infty$ are treated in considerable detail. (r_p, λ_d, T_-, T_+ are probe radius, Debye length, electron and ion temperature, respectively.) It is found that when $\rho_p \to \infty$, quasi-neutrality breaks down near the probe surface. A new expansion is necessary within the space charge sheath. This expansion is made and the lowest order equation is solved numerically. The matching between sheath and quasi-neutral solutions is given properly in an asymptotic sense. Ion and electron density distributions, electric field and current-voltage characteristics are computed. 44 references. (auth)

35026 (NP-13059) CLUSTER-EXPANSION CORRECTIONS OF THE DEBYE-HÜCKEL PAIR-CORRELATION FUNCTION FOR IONIZED GASES. Technical Report No. 1. Charles F. Hooper, Jr. (Johns Hopkins Univ., Baltimore). June 1963. Contract Nonr-248(57). 113p.

The Kolb-Griem theory of spectral line broadening occurring in plasmas is discussed; emphasis is placed on the importance of the electric microfield distribution. The Mozer-Baranger calculation of the electric microfield distribution in a plasma is outlined; its dependence upon the nature of the component particle correlations is shown. The electrons and ions must be treated separately because of their inherent differences; the electrons interact through a Coulomb field, whereas the ions interact with shielded fields. The Salpeter cluster-expansion technique is considered in detail. It is applied to the determination of pair correlation functions and the corresponding potentials of mean force for both Coulomb and shielded fields. The calculations are made up to second order in complexity. Corrected expressions for the potentials of mean force are compared with the corresponding Debye-Hückel results. Significant differences are found particularly for the shielded-field cases. It is demonstrated that use of the corrected pair-correlation functions in the Mozer-Baranger microfield calculation could significantly alter the results. The possibility of including such corrected results in the line-broadening theory is considered; it is indicated that the influence of these corrections on the profile of the Lyman-β line should be experimentally observable. 53 references. (auth)

35027 (R63SD60) EFFECT OF MICROWAVE RADIATION ON THE IONIZED GAS BEHIND A STRONG NORMAL SHOCK WAVE. K. T. Yen (General Electric Co. Missile and Space Div., Valley Forge Space Technology Center, King of Prussia, Penna.). July 1963. Contract AF30 (602)-1968. 20p.

The interaction between microwaves and a fully-ionized

gas behind a normal shock wave is analyzed. The governing differential equations derived by a quasi-steady analysis are used to obtain the non-dimensional parameters and integrated to yield the "first integrals" of the momentum and energy equations. A modified Prandtl relation is derived from which the final equilibrium state of the ionized gas can be found. Ionization is seen to increase the final equilibrium density, while microwave heating tends to reduce its value. It is further shown that thermal choking of the ionized gas occurs at a critical microwave power level, which is a function of the Mach number ahead of the shock wave, the reflection coefficient of the microwave, and the ionization potential expressed in terms of the neutral gas temperature ahead of the shock wave. At higher power levels, the shock wave moves upstream allowing additional microwave heating of the ionized gas. A formula is given for the determination of this equivalent higher Mach number. At a sufficiently high power level (but slightly below the critical value), the mean gas temperature is shown to attain a peak value higher than its final equilibrium value. This peak temperature actually represents the upper bound of the mean gas temperature for a given initial Mach number. (auth)

35028 (RM-3696-PR) THE PLASMA RESONANCE IN INCOHERENT SCATTERING OF RADIO WAVES FROM A FULLY IONIZED PLASMA. Victor Gilinsky and Donald DuBois (RAND Corp., Santa Monica, Calif.). July 1963. Contract AF49(638)-700. 21p. (AD-411807)

The shape of the plasma resonance in the spectrum of radio waves incoherently scattered from a hot plasma is calculated including the lowest order effects of close collisions in the limit of long wavelength of the radiation and high plasma temperature. Applicability of the results for radio wave scattering from ionospheric plasmas is discussed. (auth)

35029 (SC-4911(RR)) ARGON OPERATION OF THE 120-KW SANDIA ARC JET FACILITY. W. B. Brooks and G. E. Reis (Sandia Corp., Albuquerque, N. Mex.). May 1963. Contract AT(29-1)-789. 54p.

Since the arc jet promises to be a test facility capable of matching the specific energies of actual flight over sustained periods, Sandia Corporation is operating a pilot 120-kw plasma jet facility to evaluate its operating parameters and potential usefulness through a combination of theoretical and experimental efforts. The predictions of a somewhat simplified theoretical analysis are shown to agree reasonably well with the observed experimental data. The study casts some doubt on the wisdom of using Langmuir probes in this kind of facility. (auth)

35030 STRUCTURE OF A LARGE-RADIUS PINCH DISCHARGE. Robert G. Jahn and Woldemar von Jaskowsky (Princeton Univ., N. J.). AIAA (Am. Inst. Aeron. Astronaut.) J., 1: 1809-14(Aug. 1963).

A large-radius pinch discharge produces a series of cylindrically symmetric, inwardly propagating current sheets and associated magnetic fields in a form convenient for detailed study of the $j \times B$ interactions basic to all schemes of electromagnetic gas acceleration. The discharge is examined by streak and Kerr cell photography, magnetic probes, spectroscopy, microwaves, and terminal measurements of current and voltage fluctuations, in order to determine the detailed distribution of the currents and fields as functions of radius and time. The initiation of the main discharge in a uniform peripheral ring is found to be primarily an inductive effect, conditioned somewhat by the presence of the adjacent insulator surface. Spectrograms of discharges in argon, nitrogen, and helium show singly and doubly ionized species indicating that particles of energy in excess of 25 ev are participating in the breakdown. A precursor front is observed to propagate ahead of the first current sheet and is identified tentatively as a gasdynamic shock. Another precursor, propagating many times faster, preionizes the gas slightly, prior to the arrival of the first current sheet. (auth)

35031 THE KINETIC THEORY OF WEAKLY IONIZED PLASMAS IN MAGNETIC FIELDS. H. Falkenhagen and W Ebeling (Universität, Rostock, Ger.). Ann. Physik (7), 10: 347-59(1963). (In German)

A hierarchy of equations for the distribution functions of electrons and ions in weakly ionized plasma in magnetic fields was derived using the Bogolyubov method. The collisions of charged particles with neutral particles were considered with the Boltzmann or Fokker-Planck collision terms. Closed equations for the distribution functions of the first or second order were found from a series development. Under the assumption of a Maxwell distribution of the pulse, corresponding equations for the spatial distribution functions were found. The equations established are also valid for electrolytes, although electrophoretic effects are still not attainable. The theory developed was used in order to investigate the relaxation of the ion atmosphere and the frequency dispersion of the tensors of the complex dielectric constants in exterior magnetic fields. (tr-auth)

35032 POPULATION INVERSION IN A DISCHARGE IN A MIXTURE OF TWO GASES. N. G. Basov and O. N. Krokhin (Lebedev Inst. of Physics, Moscow). Appl. Optics, 1: 213-16(May 1962).

Conditions for the formation of a population inversion in a gas discharge in a two-gas mixture, the atoms of which have equal energy levels, are considered. (auth)

35033 AN ADIABATIC TRAP WITH A COMBINED MAGNETIC FIELD. Yu. T. Baiborodov, M. S. Ioffe, V. M. Petrov, and R. I. Sobolev. At. Energ. (USSR), 14: 443-5 (May 1963). (In Russian)

Results of the preliminary experiments on the containment of the plasma in an adiabatic trap, in which the magnetic field increases not only in the longitudinal but also in the radial direction, were reported at the 1961 Conference on Controlled Fusion in Salzburg. The design is based on the inhibition of the formation of plasma instabilities by increasing the radial field, eliminating the leakages occurring in ordinary magnetic traps. An improved version, designated as PR-5, was built in 1962; this trap was provided with a combined magnetic field at a higher vacuum. A d-c generator was used to supply the 5000-oersted longitudinal magnetic field while the 4500 oersted for the stabilizing field was fed by a condenser battery. The tests carried out indicated the absence of magnetohydrodynamic instabilities in the trap; the plasma lifetime depended only on the excess charge of the fast ions in the neutral gas. The maximum decay time of the plasma was found to reach 10 to 15 milliseconds. The experimental data obtained during the preliminary tests were confirmed. (TTT)

35034 INJECTION OF AN ION BEAM INTO THE MAGNETIC TRAP "OGRA." A. L. Bezbatchenko, V. V. Kuznetsov, N. P. Malakhov, and N. N. Semashko. At. Energ. (USSR), 14: 446-52(May 1963). (In Russian)

Previous studies with the "Ogra" machine indicated that, assuming a stable confinement of the plasma, the injection current needed for ensuring the passage through a high density plasma, decreases suddenly with increasing energy and with the increasing mean free path of the molecular ions in the trap. Improved ion sources required an ion energy of 200 kev with an impossibly long path length of 10^5 cm. In

the Ogra, because of the finite angular divergence of the beam, this length is about 10 m. The methods considered for injecting a particle beam into the magnetic field included a supplementary acceleration of the ions during entry into the magnetic field, slowing it down to the initial energy when leaving the field; compensation of the deflecting action of the magnetic action by a transversal electric field and entry across the magnetic channel, i.e., through the Fe screen with a compensating coil which reduces the internal field in the channel. The latter method was adopted. A molecular hydrogen ion beam with an energy up to 180 kev was focused and injected into the magnetic field of the Ogra. The ion current introduced into the trap reached about 150 ma. It was found that the disturbance of the magnetic field of the Ogra at the operating zone did not exceed a few percents. The ion current was somewhat larger than expected; this is probably due to a supplementary focusing action of the deflecting field of the magnetic channel and to the additional compensation of the space charge of the beam by secondary electrons. (TTT)

35035 CALCULATION OF THE ELECTRON DISTRIBUTION FUNCTION OF A PLASMA BEGINNING WITH THE FOKKER-PLANCK EQUATION. Pierre Bertrand, Raymond Jancel, and Théo Kahan (Institut H. Poincaré, Paris). Compt. Rend., 257: 100-2(July 1, 1963). (In French)

In dependence on the results established previously (Compt. Rend. 265: 4628(1963)), based on a spherical harmonics development, the first-approximation equations for the electron distribution function of a plasma exposed to a magnetic field and an alternating electrical field were derived. (tr-auth)

35036 ROTATION VELOCITY OF A CYLINDRICAL LAYER OF PLASMA IN A CROSSED FIELD CONFIGURATION. Michele Fumelli (CEN, Fortenay-aux-Roses, France). Compt. Rend., 257: 633-4(July 17, 1963). (In French)

The electrodynamic forces that act on a cylindrical layer of plasma turning in a crossed-field configuration in the presence of neutral gas compensate the dissipation of energy from ion–neutral atom collisions on the walls at the layer boundary. A relation between the rotation velocity of the layer in the stationary state and some parameters such as the value of the magnetic field, the density of the neutral gas and of the plasma, and the current crossing the layer was deduced. (tr-auth)

35037 THE INTERACTION OF HIGH-DENSITY PLASMOIDS WITH A MAGNETIC FIELD. V. F. Demichev and V. M. Strunnikov. Dokl. Akad. Nauk SSSR, 150: 523-6 (May 21, 1963). (In Russian)

The interaction of a plasma jet with a rising longitudinal magnetic field, and the collision of the jet with the barrier formed by a strong, transverse magnetic field were investigated. The average velocity of the deuterium plasmoid was $v_0 \simeq 6.6 \times 10^8$ cm/sec; the concentration of the plasma was $n_0 \simeq 2$ to 3×10^{15} cm^{-3}; the total energy was $Q_0 \simeq 100$ joules, and the average conductivity of the plasma was $\sigma \simeq 10^{14}$ CGS units. The plasmoid had the form of a jet 30 to 40 cm in length at a distance of 50 cm from the injector, where a coil was placed to create a magnetic field with a strength of up to 30 kilooersteds. On increasing H from 0 to 18 kilooersteds, the velocity of the front part of the jet decreased by 25 to 30%, while the velocity of that part of the jet stream generating the most current in the magnetic field fell by a factor of 2 to 3 (2 to 3×10^8 cm/sec). Part of the plasma jet was completely stopped and reflected from the magnetic barrier at H > 3 kiloersteds. Calorimetric measurements showed that only 30% of the initial energy of the jet stream penetrate the barrier at H = 18 kiloersteds. The barrier was less transparent with a higher field gradient of $\partial H/\partial z = 0.08\ H_{max}$ oersteds/cm than it was with a lower field gradient of $\partial H/\partial z = 0.04\ H_{max}$ oersteds/cm. Noticeable penetration of the jet through the barrier was observed, even when H = 30 kiloersteds. In this case, the ratio $(H^2)/(8\pi) \cdot (\rho_0 v_0^2)/(2) = 150$ to 200 (ρ_0 is the initial density of the plasma). Because of radial compression of the plasma, the ion concentration in the jet stream increased by greater than a factor of 10 at H = 6 kiloersteds compared to the ion concentration at H = 0. The ion concentration increased by a factor of 30 at H = 24 kiloersteds ($n = 6 \times 10^{16}$ cm^{-3}). The penetration of the barrier by the jet stream could be explained by the finite conductivity of the plasma. (TTT)

35038 THE SUYDAM INSTABILITY WITH A FINITE LARMOR ION RADIUS. L. V. Mikhailovskaya and A. B. Makhailovskii. Dokl. Akad. Nauk SSSR, 150: 531-2(May 21, 1963). (In Russian)

Suydam showed that a plasma contained by a spiral magnetic field $H = (O, H_\phi(r), H_z(r))$ is unstable with respect to perturbations of the form $f = f(r) \exp(im\phi + ikz - i\omega t)$, which are localized near a magnetic surface $r = r_0$, if $x^2 \equiv -(8\pi p')/(rH_z^2)\,(\mu/\mu')^2|_{r=r_0} > (1)/(4)$. Here $\mu = H_\phi/rH_z$; $p = n(T_i + T_e)$ is the equilibrium plasma pressure; n is the equilibrium density; T_i and T_e are the ion temperature and electron temperature. The apostrophe indicates a differentiation with respect to r. It is assumed that the frequency of the perturbation ω is much smaller than the cyclotron frequency of the ions $\Omega_i = eH/M_ic$, and that the Larmor ion radius $\rho = \sqrt{T_i/M_i\Omega_i^2}$ is much smaller than the wavelength of the perturbation $\lambda \sim (m^2/r^2 + k^2)^{-0.5}$. If the instability increments are small enough, the magnetodynamic approximation can be improved by taking into account small terms such as $(\rho/\lambda)^2$. It was found that the plasma is stable even at large values of x^2, if the Larmor radius of the ions is large enough that $(m\rho/r)^2 > (a/R)\,[1 + (T_e)/(T_i)]$. Here a is a characteristic dimension of an inhomogeneous plasma, $a^{-1} = d\ln p/dr$; and R is the radius of curvature of the force line, $R = r(H/H_\phi)^2$. Thus, the plasma tends to stabilize, if the finite Larmor ion radius is taken into account. (TTT)

35039 THE EFFECT OF "DRIFT" WAVES ON THE DIFFUSION OF A PLASMA IN A MAGNETIC FIELD. V. N. Oraevskii and R. Z. Sagdeev. Dokl. Akad. Nauk SSSR, 150: 775-8(June 1, 1963). (In Russian)

In a magnetic trap with a large Larmor radius ($K_i/r < 1$, K_i is the Larmor radius of the ions, and r is the transverse length of the trap), there exists a "universal" instability, and it is of interest to determine how magnetic containment of the plasma is affected by the pulsations. Two cases can be distinguished: $p^2/(H^2/8\pi) = \beta < m/M$, and $m/M < \beta \ll 1$. In the first case, the instability is of an aperiodic type with a growth increment $\nu \sim k_0 v_i$ (where $k_0 \equiv (1/n_0)(dn_0/dx)$ and v_i is the thermal ion velocity). It was found that the anomalous diffusion coefficient $D \sim (r_i/r)(cT/eH)$. In the second case, the instability is due to the rolling of "drift" waves as a result of the instability, and to the non-linear effects because of interaction between various "harmonics." Here, the anomalous diffusion coefficient $\overline{D}_x \simeq {}_e r\,(v_a v_e)$, where v_a is the frequency of electron collisions, and v_e is the electron thermal velocity. (TTT)

35040 THE PROBLEM OF THE RADIATION OF EASILY IONIZED PLASMA MIXTURES IN THE CASE OF THERMAL EXCITATION. O. P. Semenova and M. A. Levchenko (Kuibyshev State Univ., Tomsk, USSR). Dokl. Akad. Nauk, SSSR, 151: 90-1(July 1, 1963). (In Russian)

Previously it was generally accepted that the function of

the intensity of the spectral lines emitted by a plasma by a thermal excitation mechanism, passes theough a maximum at a temperature T_M; the value of this maximum depends on the ionization potential of the emission atoms and the excitation energy E. The correlation between T_M, V, and E is complicated by the interaction of the residual atoms in the plasma. The effect of the plasma composition is also noted by the appearance of a second maximum in the I(T) function if readily ionizable mixtures are present. The conditions of the formation of this second maximum were examined. The calculations indicated that the location of the second high-temperature maximum is greatly dependent on the ionization potential of the base plasma and it is much less dependent on the characteristics of the admixture, V_{adm}, and E because it is affected not by V_{adm} itself but by the difference $V_{adm} - E$. If the plasma possesses a complex composition, several maxima may be observed. This rule may be applied more generally to the emission of ionic lines. (TTT)

35041 PLASMA FURNACES—HIGH FREQUENCY AND HIGH TEMPERATURES. J. Reboux. Ingrs. Techniciens, No. 166, 109-16(June 1963). (In French)

The electric conductivity and thermochemistry of plasma are discussed, with respect to their influences in plasma furnaces. The operating parameters of inductive plasma furnaces are outlined, along with the effects of the parameters on the properties of the plasma. Production of high-power plasma is discussed. Containment and constriction requirements for the plasma under consideration are described. Applications of this type of plasma furnace are summarized, with examples shown of the performance of Ar, He, N_2, and H_2 plasma furnaces. (T.F.H.)

35042 UNIFIED THEORY OF RELAXATIONS IN PLASMAS. II. APPLICATIONS. Taro Kihara, Osamu Aono, and Yukikazu Itikawa (Tokyo Univ.). J. Phys. Soc. Japan, 18: 1043-50(July 1963).

The basic theorem is applied to two-component plasmas. The relaxation between ion and electron temperatures, attenuation of low-frequency oscillations, diffusion, and thermal conduction across a magnetic field, and relaxation of an anisotropic distribution of ion velocities are treated. The rates of these relaxations with exact numerical factors in the arguments of the Coulomb logarithms are obtained. (auth)

35043 MICROWAVE REFLECTION BY MAGNETOPLASMAS. Takashige Tsukishima and Susumu Takeda (Nagoya Univ., Japan). J. Phys. Soc. Japan, 18: 1056-61 (July 1963).

The microwave powers reflected by magnetoplasmas are examined experimentally and compared with theoretical values at resonances calculated under an approximation, in a range where ω_p^2/ω^2 is close to unity and for small ω_c/ω, where ω_p is the plasma frequency, ω is the applied microwave frequency and ω_c is the electron cyclotron frequency. It is demonstrated that the reflection method adopted is useful for detecting the electron resonances that appear approximately at $1-\omega_p^2/\omega^2 = \omega_c^2/\omega^2$, in particular for small ω_c/ω. Moreover the collision frequency ν can be estimated from the relative value of the reflected power at resonance. The incident microwave power is most efficiently absorbed at a relatively small value of ω_c/ω, for instance, at $\omega_c/\omega \simeq 0.3$ for $\nu/\omega \simeq 0.1 \times (\omega_p^2/\omega^2)$. (auth)

35044 HARMONIC STRUCTURE OF THE RADIATION FROM A CHARGE MOVING THROUGH A MAGNETOPLASMA. Ryo Sugihara (Tokyo Univ.). J. Phys. Soc. Japan, 18: 1062-5(July 1963).

A theoretical investigation is made of the radiation from a charge moving along a magnetic field with a fast but nonrelativistic velocity, the spatial dispersion of the dielectric tensor being taken into account. In addition to the peak of the well-known Cherenkov radiation, discrete peaks appear in the spectrum of radiation near frequencies $\omega = s\omega_{ji}(s \geq 2)$, that are the higher harmonics of the gyromagnetic frequency of the plasma electrons. The intensity of each peak is almost constant over several peaks which correspond to the harmonics number of the order of unity. (auth)

35045 COLLISIONAL DAMPING OF PLASMA OSCILLATION. Masatada Ogasawara (Tokyo Univ.). J. Phys. Soc. Japan, 18: 1066-73(July 1963).

The coefficient of collisional damping of the electron plasma oscillation is calculated by means of Boltzmann's collision term in the limit of long wave length. The damping coefficient is given by $\omega_i = {}^1/_2 \Lambda_{00}^{(1)} + {}^2/_3 (\Lambda_{00}^{(2)} + \lambda_{00}^{(2)})(k/k_D)^3$, where k_D is the inverse of the Debye length and k is the wave number. The constants $\Lambda_{00}^{(1)}$, $\Lambda_{00}^{(2)}$, and $\lambda_{00}^{(2)}$ are collision integrals. The first corresponds to the change of the momentum of the electrons due to collisions with the ions. The second and the third are equal to the rates of relaxation of the elliptic velocity distribution of the electrons due to electron-ion and electron-electron interactions, respectively. (auth)

35046 THE DISPLACEMENT OF THE SPECTRAL LINES OF He II IN A DENSE PLASMA. L. P. Kudrin and G. V. Sholin. Opt. Spectry. (USSR) (English Transl.), 14: 322-4(May 1963).

The position of the intensity maximum of the profile of the He II line is determined as a function of plasma density. The weak dependence of the shift on temperature and the almost linear dependence on density is noted. The divergence from linear dependence is accounted for by the quasi-static quadrupole interaction with ions. The computation is slightly sensitive to the exact ion distribution and depends weakly upon the electron collision width. (C.E.S.)

35047 EMPLOYMENT OF LIGHT CONDUCTION AS LIGHT PROBE FOR STUDY OF PLASMA. E. Raeuchle (Technische Hochschule, Stuttgart). Phys. Letters, 5: 242-4(July 15, 1963). (In German)

35048 THE MECHANISM OF TONKS-DATTNER PLASMA RESONANCES. F. W. Crawford (Stanford Univ., Calif.). Phys. Letters, 5: 244-7(July 15, 1963). (In English)

A hypothesis is developed that successfully explains experimental results on the Tonks-Dattner resonances. The usual dispersion relation for pressure waves propagating in an infinite uniform plasma is considered as well as the locations, amplitudes, and numbers of distinguishable resonances. The effects of pressure, external fields, electron temperature, and exciting electrode dimensions on the Tonks-Dattner resonances are summarized. It is concluded that internal plasma resonances can occur due to standing waves between the cut-off and propagating regions of the column and that these successfully explain the phenomenon of Tonks-Dattner resonance. (R.E.U.)

35049 SELF-EXCITED PLASMA SURFACE-WAVES. J. M. Jones (Queen's Univ., Belfast). Phys. Letters, 5: 324-5(Aug. 1, 1963). (In English)

The self-excited surface waves in a low-voltage hot-cathode discharge in mercury plasma were investigated. In the range 40 to 300 Mc the oscillation spectrum had continuous background together with several pronounced mono-

chromatic peaks. The wave patterns recorded had a strong standing wave component, presumably produced by reflection of the waves due to imperfect matching at the anode. The wavelengths varied a little along the column because of the change in plasma-electron concentration. (C.E.S.)

35050 X-RAY CRYSTAL SPECTROSCOPY OF A THETA-PINCH PLASMA IN THE REGION 15–25Å. G. A. Sawyer, A. J. Bearden, I. Hennis, F. C. Jahoda, and F. L. Ribe (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 131: 1891-7(Sept. 1, 1963). (LADC-5518)

A new synthetic crystal, potassium acid phthalate, has a spacing between crystal planes, 2d = 26.6 Å. The use of this crystal in a Bragg crystal spectrometer has permitted measurement of the Scylla I x-ray spectrum from 15 to 25 Å, a region inaccessible with the beryl crystal previously used. The principal features of the observed spectrum in this region are the lines of O_{VII} and O_{VIII} arising from oxygen contamination of the discharge by material from the ceramic discharge tube. Six lines of the resonance series of O_{VII} are observed, including both $1s^2\ {}^1S_0 - 1s2p\ {}^1P_1$ and $1s^2\ {}^1S_0 - 1s2p\ {}^3P_1$. The first members of the Lyman series of O_{VIII} are also observed. Measurements of Doppler widths of the lines of O_{VII} and O_{VIII} yield an oxygen-ion Doppler temperature of 9.3 ± 2.8 kev. These measurements, when combined with those previously made on other ion species, show that the ions of the plasma are not in collisional equilibrium. (auth)

35051 SHIFTS AND WIDTHS OF SOME STARK-BROADENED OXYGEN LINES IN AN ARC PLASMA. W. L. Wiese and P. W. Murphy (National Bureau of Standards, Washington, D. C.). Phys. Rev., 131: 2108-15(Sept. 1, 1963).

A thermal oxygen plasma was generated in a wall-stabilized arc, and its temperature and electron density were determined spectroscopically from the intensity measurement of an oxygen line of known transition probability. Observations were made over the range of electron densities from (1 to 6) × 10^{16} cm^{-3} and for temperatures around 10,000°K. The profiles of several oxygen lines were scanned end on and side on, and the shifts and half-widths were compared with the results of a recently developed Stark-broadening theory for isolated lines of heavy elements. The agreement in the half-widths is very good, with deviations usually smaller than 10%. The ratio of measured to calculated width averaged over the six investigated multiplets is 1.00 with a standard deviation of ±0.06. However, the agreement in the shifts is good only in those cases where the shifts are large. For the two strongly broadened multiplets at 6046 and 6455 Å, detailed side-on observations were made at various radial distances. They show the theoretically expected linear dependence of half-widths and shifts on the electron density over the measured range. For the strong multiplet at 6455 Å the intensity distribution in the distant line wings was measured, too, and could be represented by power laws with exponents of −1.96 for the blue wing and −1.91 for the red wing, in close agreement with theoretical asymptotic formulas. (auth)

35052 STABLE LONGITUDINAL OSCILLATIONS IN ANISOTROPIC PLASMA. Terry Kammash and Warren Heckrotte (Univ. of California, Livermore). Phys. Rev., 131: 2129-30(Sept. 1, 1963). (UCRL-7275)

The dispersion equation for longitudinal oscillations in an infinite collisionless anisotropic plasma in a uniform magnetic field is analyzed. For a plasma in which the electrons are isotropic and the ions are anisotropic with a velocity distribution given by a two-temperature Maxwellian, it is found that a purely growing mode with frequency of the order of the ion cyclotron frequency cannot exist so long as the ion temperature perpendicular to the field is larger than its temperature along the field. This is demonstrated by showing that the dispersion equation has no solutions under these conditions. (auth)

35053 THE IONIC CENTRIFUGE CAN GIVE FUSION NUCLEAR POWER. Joseph Slepian. Proc. Natl. Acad. Sci. U. S., 50: 6-9(July 15, 1963).

Equations for the behavior of plasma in an ionic centrifuge are compared. Topics covered include: the equations offered by Spitzer, the equations offered by Ferraro and Plumpton, the first discharge of the ionic centrifuge, and the second discharge of the ionic centrifuge. (M.C.G.)

35054 INVESTIGATION OF PLASMA DECAY IN A STRONG MAGNETIC FIELD. V. S. Golubev (Moscow State Univ.). Radiotekhn. i Elektron., 8: 1253-63(July 1963). (In Russian)

Ion lifetimes in hydrogen and argon plasma in longitudinal homogeneous magnetic fields of 0 to 10 to 15 k gauss at 0.03 to 1 mm Hg pressures were studied. In increasing magnetic fields the ion lifetimes tend toward certain limitations due to prevailing volume recombination. The diffusion lifetime (separated from the total lifetime) is a function of magnetic field in accord with collision theory. Ion distribution in plasma decaying in a magnetic field was also investigated. Variations in time distribution correspond to the recombination plasma decay in strong magnetic fields. (tr-auth)

35055 THE "SLANT-LINE EFFECT" IN AXIAL GAS DISCHARGES IN THE NEIGHBORHOOD OF AXIAL MAGNETIC FIELDS. H.-W. Drawin (EURATOM-CEA, Fontenay-aux-Roses, France). Z. Physik, 174: 489-506 (1963). (In German)

In axial gas discharges with superposed axial magnetic fields "inclined" or "slant" spectral lines can be observed, if at the same time radial electric fields are present. The inclination of the lines can be explained by the assumption of a completely or partially rotating plasma column. The velocity of rotation which is a function of the radius can only be measured by spectroscopic means. A method was developed which permits the calculation of the velocity of rotation as well as the calculation of the distribution function of the particle velocity from spectroscopic measurements of the line profiles. (auth)

35056 CHARGED PARTICLES FROM THE ENDS OF A MAGNETIC MIRROR PLASMA. P. K. John, James F. Holt, and M. L. Pool (Ohio State Univ., Columbus). 16p. (CONF-78-10)

From American Physical Society, 1963 Summer Meeting, Buffalo, June 1963.

A magnetic mirror machine is considered in which the plasma is excited by 3-phase r-f coils placed in the midplane between the mirror coils. Displacement of the mirror coils by a small amount is found to produce an axial current through the plasma. For r-f coils in the midplane, the energy distributions of the ions escaping through the mirrors are determined. These determinations, together with the mirror-escape condition, are used to calculate an upper limit for the charge density of the plasma. Hydrogen and deuterium are used at pressures near 5 microns. (T.F.H.)

35057 THE DIELECTRIC CONSTANT OF A PLASMA. Richard L. Moore (Douglas Aircraft Co., Inc., Long Beach, Calif.). 6p. (CONF-46-77)

From American Physical Society Meeting, Washington, D. C., Apr. 1963.

A deficiency in the theory of coupling between compression waves and electrical waves in a fully ionized plasma is mathematically demonstrated, and experiments for testing the situation are proposed. (auth)

35058 NONEQUILIBRIUM ELECTRON TEMPERATURE EFFECTS IN WEAKLY IONIZED STAGNATION BOUNDARY LAYERS. Paul M. Chung and James F. Mullen (Aerospace Corp., Los Angeles). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-161, 29p, $1.00. (CONF-97-12)

From Summer Meeting, Los Angeles, June 1963.

An electron energy equation is formulated for weakly ionized stagnation boundary layers over highly cooled surfaces. Only the cases of moderately negative wall potential with respect to the plasma are considered wherein the ratio of the electron to ion current densities is between about 10^{-1} to 10. The equation is simplified by taking advantage of the fact that the electron energy equation is rather insensitive to the detailed variation of the electron concentration profile. A solution of the simplified electron energy equation is obtained analytically for the cases where the electron temperatures are not in equilibrium with the neutral gas temperatures. The effects of nonequilibrium electron temperatures on the electrical characteristics of the boundary layer are then analyzed. It was found that the equilibration process (of the electron temperatures to the neutral gas temperatures) is controlled by the ratio of the characteristic electron energy conduction time to the characteristic temperature equilibration time. The characteristic residence time of electrons was conventionally used instead of the conduction time. The ion current is found to depend on the electron temperature but is practically independent of the potential. (auth)

35059 TRANSIENT PLASMA DIAGNOSTICS FOR WAKE STUDIES. K. Baldwin, R. Buck, T. Fenssenden, and L. McGuire (Avco Corp., Wilmington, Mass.). 28p. (CONF-87-1)

From Symposium on Hypervelocity Techniques, Denver, Mar. 1962.

An integrated set of microwave plasma diagnostic techniques for measuring electron density and collision frequency in the ionized wake of a hypersonic projectile are described. In order to examine as much of the wake as possible, measurements are performed at 250, 3000, 35,000, and 70,000 mc. Resonant cavities are utilized at the two lower frequencies while at the upper two frequencies focused-beam interferometers are employed. Over the measuring range of each instrument, continuous data are obtained with a time resolution of 10 μsec. This resolution is adequate for projectiles traveling at velocities of 25,000 ft/sec. The effect of inaccurate trajectory on the cavity measurements is considered. In addition, the problems of wake-diameter growth and radial plasma density gradients are discussed. Several approaches to equipment design are mentioned. Different techniques were necessary over the wide frequency range utilized in these experiments because of component availability. Final designs are presented along with a discussion of equipment sensitivity. The projectiles are fired by a light-gas gun into a reduced pressure range. Velocity measurements are obtained simultaneously with photographs of the in-flight projectile that fix the position of the trajectory relative to the axis of the range. (auth)

35060 QUENCHING THE PLASMA REACTION BY MEANS OF THE FLUIDIZED BED. W. M. Goldberger and J. H. Oxley (Battelle Memorial Inst., Columbus, Ohio). 24p. (CONF-99-1)

From American Inst. of Chemical Engineers Meeting, New Orleans, Mar. 1963.

The problem of quenching the products of ultrahigh-temperature reactions to give a desired selectivity and also in a way that uses their energy content is a major obstacle in the development of high-temperature processes. The use of a fluidized bed as a quench device offers advantages related to high heat transfer rates and continuity of operation. An argon plasma was injected into a bed of fluidized alumina under various conditions and the temperature measurements are given. Possible application of the fluidized-bed quench for plasma reactions are discussed. (auth)

35061 ION ACOUSTIC OSCILLATIONS IN PLASMA THERMIONIC ENERGY CONVERTERS. Jay S. Chivian (Texas Instruments Inc., Dallas). 29p. (CONF-78-9)

From American Physical Society 1963 Summer Meeting, Buffalo, June 1963.

It is shown that the oscillations in low-pressure-plasma thermionic energy converters are ion acoustic oscillations that may be explained on the basis of an electron beam-plasma interaction. A low-energy beam is formed by the acceleration of electrons through an ion sheath at the emitting surface. The ion acoustic oscillations are observed when the ordered beam velocity is greater than the phase velocity of the wave and less than the plasma electron thermal velocity. Their frequency is given by $f = \lambda^{-1}(\gamma_e kT_e/m_i)^{1/2}$ where the emitter to collector spacing is a multiple of the half wavelength. Langmuir probes indicate high effective electron temperatures, and agreement between calculated and measured frequency is good if a value of $\gamma_e = 3$ is used. (auth)

35062 VACUUM ULTRAVIOLET RADIATION AS A PROBE OF RARE GAS PLASMAS. H. E. Blackwell, G. S. Bajwa, G. S. Shipp, and G. L. Weissler. 76p. (CONF-71-2)

From Fifteenth Annual Gaseous Electronics Conference, Boulder, Colo., Oct. 1963.

It is shown that the plasma absorption of ultraviolet radiation of specific wavelengths can be expressed in terms of the number densities of absorbing particles. The experiment presented illustrates this procedure of using shock-heated xenon gas to measure, as a function of time, number densities of Xe and Xe^+. Emphasis is on the experimental method rather than on a qualitative analysis of the experimental results. This method can be applied to determine number densities of doubly- as well as singly-ionized and neutral plasma particles. The validity of a straightforward application of the Rankine-Hugoniot and Saha equations using the measured shock velocity is put in doubt by precursor effects, which modify the state of the gas in front of the shock, and by questions regarding equilibrium behind the shock. The results indicate that accurate measurement of cross sections for ions is possible, provided ground-state ion densities can be obtained by other methods. A brief outline of such possible techniques is given. Since one can expect a contribution to the electron density by impurities to be no greater than 1%, it is possible to infer ion densities in the ground state from a knowledge of the electron concentration and temperature if complete thermal equilibrium is reached. Local thermal equilibrium can be reached for the higher electronic states, but equilibrium between the ground state population and those of the higher states is less likely. This is due to the much greater energy separation between the ground and the next higher excited state. But if complete equilibrium does

not exist, comparison between the ground state population and the population of the higher states, as inferred from these plasma radiation intensity measurements, is a point of interest. In this case ground state populations can be determined only by the method presented here using known photoionization cross sections. The experimental result of this technique is the product of the cross section and the density, ($n\sigma$). It is necessary then to use calculated values of one in order to measure the other, or to use results of one obtained in an alternate measurement. Plasma radiation intensity measurements give results which are functions of the oscillator strengths and the temperature: one must be known to obtain the other. (auth)

Shielding

35063 (CONF-39-61) COMPUTER ANALYSIS OF THERMAL STRESSES IN ANNULAR CONCRETE SHIELD—THE STATURE CODE. David R. Thomas (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). May 1963. Contract AT(30-3)-222. 16p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

The permissible limits of energy absorption within thick concrete shields were investigated using the STATURE program. The one-dimensional heat flow equation was evaluated, considering the effects of energy absorption buildup within the shield, boundary heat transfer conditions, and the contribution of gammas generated within the shield by capture of the incident neutrons. The results show that the use of such shields is limited by stress buildup rather than temperature buildup. Also, external steel reinforcement appeared more effective for preventing failure from tensile stresses than did additional shielding. (D.C.W.)

35064 AS TO THE TECHNOLOGY OF SHIELDING MATERIAL. F. Bremer (Fried, Krupp Baubetriebe, Essen). Kerntechnik, 5: 293-5(July 1963). (In German)

The shielding effect of cement concrete can be largely varied by adding aggregates of different specific weights. Chemically bound water in clinkers favors the absorption of neutrons. By means of adequate aggregates the water content may be increased. The processing and the installation of precast concrete parts in any requested shapes do not produce the slightest difficulties. (P.C.H.)

35065 MARBOLITE—A NEW SYNTHETIC MATERIAL. PART II. GAMMA RAY SHIELDING MEASUREMENTS ON MARBOLITE AND OTHER MATERIALS. Zohra Haider, M. K. Husain, and F. Shaikh (Pakistan Council of Scientific and Industrial Research, Karachi). Pakistan J. Sci. and Ind. Res., 6: 90-2(Apr. 1962). (In English)

Gamma-ray shielding (absorption and scattering) properties of a new synthetic material Marbolite, were studied and compared with other shielding materials, especially lead and natural marble. For temporary shielding, Marbolite turns out to be much cheaper than lead and marble for the same percentage absorption. Ease of handling and fabrication in any desired size and shape coupled with acid and alkali resistant property, makes it an excellent shielding material for radiochemical laboratories. (auth)

35066 EFFECTS OF INTERFACES ON GAMMA SHIELDING. C. E. Clifford (Defence Research Chemical Labs., Ottawa). 14p. (CONF-39-57)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

A survey is presented of studies of interface effects in gamma shielding problems. These studies are grouped into three types of approaches, viz.: sources at the interface; radiation backscattered from the interface; and radiation transmitted through the interface. A bibliography of 54 references is included. Limitations on the applicability of the results are discussed. (T.F.H.)

35067 COMPARISONS OF ROOF REDUCTION FACTORS USING THE MONTE CARLO METHOD AND THE MOMENT METHOD. D. J. Raso. 9p. (CONF-39-78)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Gamma attenuation factors calculated by Monte Carlo and moment methods for flat, infinite-plane roofs are compared. The calculations are also carried out for roofed structures having walls that can reflect or transmit the radiation. (T.F.H.)

Theoretical Physics

35068 (JINR-E-1275) INFRARED SINGULARITIES OF MATRIX ELEMENTS IN SCALAR ELECTRODYNAMICS. L. D. Solov'ev and Yu. Ya. Yushin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1963. 9p.

Expressions for the infrared (near threshold) singularities of the matrix elements in scalar electrodynamics are obtained by summing up the perturbation theory series with the aid of the renormalization group. The matrix elements of the photon-meson, electron-meson, and meson-meson scattering are treated. A comparison of the results with the corresponding expressions for spinor electrodynamics shows that the form of the main infrared singularities is independent of the charged particle spin. (auth)

35069 (NASA-TT-F-153) GENERALIZATION OF THE THEORY OF PARTIAL SEPARATION OF VARIABLES TO INCLUDE THE CASE OF MULTIVALENT ATOMS. A. P. Yutsis. Translated from Zh. Eksperim. i Teor. Fiz., 23: 371-80(1952). 22p.

With the aid of Laplace's theorem, a linear combination of determinants, expressing the wave function of the whole atom, is transformed in such a way that the quantum numbers of the inner electrons are found in minors of the determinants and the quantum numbers of the valence electrons in their cofactors. The total energy of the atom is expressed with the aid of the wave function of the whole atom thus transformed. The general expression obtained is applicable to the case where the variables of the inner electrons are completely separated, and where the approximation of partial separation of variables applies to the valence electrons. This last expression for the total energy of the atom contains the spin-spin dependence in general form. (auth)

35070 THE POSSIBILITY OF SOLVING EXPERIMENTALLY THE PROBLEM OF THE "COMPLETE" CHARACTER OF QUANTUM MECHANICS. Mioara Mugur-Schaechter. Compt. Rend., 256: 5541-17(June 24, 1963). (In French)

The possibility was shown, by an analysis of the quantum theory of measurement, of solving experimentally the problem of the "complete" character of quantum mechanics. The same procedure permits an experimental verification of the theory of the double solution. It is also evident that there is independence between the uncertainty principle and the indeterministic character of the quantum formulism. (tr-auth)

35071 AN EXTENSION OF POMERANCHUK'S THEOREM TO DIFFRACTION SCATTERING. L. Van Hove (CERN, Geneva). Phys. Letters, 5: 252-3(July 15, 1963). (In English)

An analysis of the invariant scattering amplitude for the elastic scattering A + B → B + A is considered with spin neglected. This analysis also applies to π + p scattering, except that the proton spin is neglected. (R.E.U.)

35072 FORWARD AND BACKWARD "SELECTION RULE" IN A CLASS OF INELASTIC COLLISIONS. G. Morpurgo (Università, Genoa and Istituto Nazionale di Fisica Nucleare, Genoa). Phys. Rev., 131: 2205-7(Sept. 1, 1963).

A rigorous rule which forbids forward and backward scattering is established for a certain class of inelastic collisions. The rule depends only on conservation of angular momentum and parity, and is therefore true, independent of the interaction and of the mechanism of the reaction. The class of collisions (called, in what follows, parity unfavored) consists of two particles A, B of spin zero colliding to produce a particle C of spin zero and D of spin S with the intrinsic parities P_A, P_B, P_C, and P_D satisfying the condition $P_A P_B P_C P_D = (-1)^{S+1}$. It is also remarked that in a parity-unfavored reaction the particle with spin S which is produced is always aligned with respect to the direction of the incident beam. Some applications in elementary-particle interactions and low-energy nuclear reactions are briefly discussed. (auth)

35073 FEYNMAN RULES FOR REGGE PARTICLES. T. W. B. Kibble (Imperial Coll. of Science and Tech., London). Phys. Rev., 131: 2282-91(Sept. 1, 1963).

The analogy between Regge poles and poles due to single-particle exchange is extended to the case of many-particle amplitudes, by considering diagrams with two or more poles. A set of diagrams is obtained in which the internal lines represent Regge particles. The problem of coupling three particles of arbitrary but physical spin is treated first, and coupling constants depending on the helicities are defined. The vertex functions which couple three Regge particles, and which have similar symmetry properties, are defined in terms of the residues of Regge poles. The propagator for a Regge particle with trajectory $\alpha(t)$ is essentially a rotation matrix for spin α, corresponding to a rotation from the initial to the final direction of the center-of-mass momentum, divided by $\sin \pi(\alpha - \sigma)$, where σ is a constant which replaces the signature. The possibility of using this formalism to predict the high-energy behavior of production amplitudes is discussed, in particular, for single-particle production. As for elastic scattering, a unified description of the low-energy and high-energy regions can be given, and the Regge poles in appropriate crossed channels should dominate in the high-energy region. (auth)

35074 PERTURBATION-THEORY RULES FOR COMPUTING THE SELF-ENERGY OPERATOR IN QUANTUM STATISTICAL MECHANICS. Gordon Baym and Andrew M. Sessler (Univ. of California, Berkeley). Phys. Rev., 131: 2345-9(Sept. 1, 1963). (UCRL-10562(Rev.))

Convenient rules are given for the general term in the time-independent perturbation-theory expansion for the self-energy operator of quantum statistical mechanics. The rules are derived by starting from the usual formalism involving time-dependent Green's functions. (auth)

35075 HIGH-ENERGY BEHAVIOR OF FEYNMAN AMPLITUDES. II. NONPLANAR GRAPHS. George Tiktopoulos (Univ. of Chicago). Phys. Rev., 131: 2373-80 (Sept. 1, 1963). (EFINS-63-24)

A method previously developed for obtaining the asymptotic behavior of Feynman integrals associated with planar graphs in the $\lambda\phi^3$ theory is extended for the study of nonplanar graphs. The results are discussed in connection with the high-energy behavior of amplitudes and the associated properties in the complex angular momentum plane. (auth)

REACTOR TECHNOLOGY

General and Miscellaneous

Refer also to abstracts 33432, 33765, 34063, and 34222.

35076 (AERE-R-4342) THE EMISSION OF VOLATILE FISSION PRODUCTS FROM URANIUM DIOXIDE. D. Davies, G. Long, and W. P. Stanaway (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). June 1963. 17p.

The post-irradiation heating technique was used to measure the rate of emission of volatile fission products from lightly irradiated UO_2 at temperatures in the range 1000 to 2200°C. At temperatures below 1600°C in low density samples the observed diffusion coefficients of I, Te, and Cs were comparable with that of Xe. In samples of higher densities, however, the rates of emission of the volatile species exceeded that of Xe. Other fission products (e.g., the alkali earths) were also emitted in small amounts; here the rate-controlling factor is believed to be the transpiration of the emitted species away from the sample. At temperatures in excess of 2000°C the emission of all volatile fission products was high, approaching 100% in some circumstances. This is attributed to sweeping out of the fission products by moving grain-boundaries in the UO_2. (auth)

35077 (ANL-6708) INTERIM REPORT: FARET EXPERIMENTAL PROGRAM. A. Smaardyk, T. R. Bump, J. Handwerk, W. J. Kann, E. L. Martinec, P. J. Persiani, G. F. Popper, and S. B. Skaldzien (Argonne National Lab., Ill.). Apr. 1963. Contract W-31-109-eng-38. 82p.

The purpose of the Fast Reactor Test (FARET) program is reviewed. Studies of engineering performance and reactor dynamics and safety are summarized. Design considerations are discussed, including basic core plan, core parameter operating data, instrumentation, coolant, and blanket. Experiments are being planned to study reactivity effects of fuel temperatures, physics irradiation, engineering irradiation, and coolant chemistry. Development of cladding materials, metallic fuel, ceramic fuel, and fuel for reactivity test is described. PERT scheduling is discussed. (M.C.G.)

35078 (ANL-6739) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, MAY 1963. (Argonne National Lab., Ill.). June 15, 1963. Contract W-31-109-eng-38. 73p.

Research and development activities are reported on Borax-V, ZPR-III, -VI, and -IX, EBR-I, EBR-II, and Treat. Reactor technology investigations are reported in reactor physics, fuels and materials development, component development, heat engineering, and chemical separations. Research and development on the Argonne Advanced Research Reactor and magnetohydrodynamics is reported. Nuclear safety development in thermal and fast reactors is discussed. (N.W.R.)

35079 (ANL-6749) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, JUNE 1963. (Argonne National Lab., Ill.). July 15, 1963. Contract W-31-109-eng-38. 67p.

Research and development activities are reported on Borax-V, ZPR-III, EBR-I, EBR-II, Faret, EBWR, and Treat. Reactor technology and investigations are reported in reactor physics, fuels and materials development, component development, heat transfer, and chemical separations. Nuclear safety development in thermal and fast reactors is discussed. Development of thermionic cells, magnetohydrodynamic generators, and the plutonium recycle program is also reported. (N.W.R.)

35080 (CONF-39-36) THE RELATIONSHIP BETWEEN HYDRODYNAMIC INSTABILITY AND POWER-VOID TRANSFER FUNCTIONS IN NATURAL-CIRCULATION BOILING WATER REACTORS. R. W. Wright and S. M. Zivi. AN ANALYSIS OF THE HYDRODYNAMIC STABILITY OF PARALLEL CHANNELS IN A NATURAL CIRCULATION BOILING WATER REACTOR. S. M. Zivi and G. C. K. Yeh (Space Technology Labs., Inc. Physical Electronics Lab., Canoga Park, Calif.). June 19, 1963. 72p.

From American Nuclear Society Annual Meeting, Salt Lake City, Utah, June 1963.

It is shown that flow-void feedback is a very important constituent in the steam void response in a natural circulation boiling loop or reactor. Very strong experimental evidence supports the postulate that an important class of hydrodynamic instabilities results from the same linear flow-void interaction that dominates the power-void transfer function. Therefore, boiling water reactor instabilities of both the power-void feedback and the purely hydrodynamic types are closely related. By virtue of this close relation the transfer function is an excellent experimental tool for the further study of hydrodynamic oscillations which arise from linear mechanisms. Two modes of parallel channel natural circulation instability are possible for low and high frequency flow oscillations. The first mode is identical to single channel flow oscillations, since all channel flows are in-phase. The second mode is identical to forced flow instabilities in parallel channel systems. Both modes of instability are predictable from properties which can be determined by laboratory measurements on a single channel. (N.W.R.)

35081 (CONF-39-44) USE OF REACTOR GAMMA RADIATION AS A REACTOR CONTROL AND SAFETY PARAMETER. D. P. Roux and S. H. Hanauer (Oak Ridge National Lab., Tenn.). [1962]. Contract [W-7405-eng-26]. 5p.

From American Nuclear Society Meeting, Salt Lake City, June 1963.

The principal advantage to be gained by using gamma radiation is that the effects of changes in core and shield configurations are greatly reduced. This is because the high neutron attenuation of water restricts the effective volume through which a neutron detector sees the core to a relatively narrow region around the path of shortest length. A gamma-sensitive detector is not so restricted and has approximately equal effective sensitivity to gamma rays emitted anywhere in a rather large volume. The results of several experiments with gamma-sensitive ionization chambers in light-water reactor shields are reported. (N.W.R.)

35082 (CONF-39-45) EXPERIMENTAL STUDIES OF TRANSIENT EFFECTS IN FAST CERAMIC REACTOR (FCR) FUELS. J. H. Field and M. J. McNelly (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). [1963]. Contract AT(04-3)-189. 16p.

From American Nuclear Society Meeting, Salt Lake City, June 1963.

Transient testing of Fast Ceramic Reactor (FCR) fuel in

TREAT is evaluated. Results are given on the maximum transient temperature to which representative FCR fuel may be taken before significant permanent damage ensues. This temperature will define the maximum transient for reliable Doppler shutdown capability. The fuel capsules studied include unirradiated uranium oxide pins, unirradiated uranium–plutonium oxide pins, and pre-irradiated uranium–plutonium oxide pins. In all cases capsules are filled with sodium and contain a heat sink designed to effectively simulate the heat removal capabilities of a flowing sodium coolant system in an operating fast reactor. (N.W.R.)

35083 (CONF-39-66) SOME EXPERIMENTS CONCERNING THE FISSION PRODUCT RETENTION OF REACTOR COOLANTS. W. P. Kunkel, D. M. Elliott, and A. S. Gibson (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). [1963]. Contract AT-11-1-GEN-8. 12p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

In the evaluation of reactor sites, the dose rate from iodine is the controlling factor in the distance criteria. Several experiments which were conducted on the retention of fission products by sodium are described, and some of the results are given. These experiments included fission product solubility in sodium, release of iodine bubbles from a sodium pool, and in-pile transient melting of fuel disks in sodium. The retention results of the last experiment were compared with these for an organic coolant. It is concluded that sodium retains all of the iodine. (D.L.C.)

35084 (CONF-39-70) A STUDY OF THE REACTION OF ALUMINUM–URANIUM ALLOY FUEL PLATES WITH WATER INITIATED BY A DESTRUCTIVE REACTOR TRANSIENT. R. O. Ivins (Argonne National Lab., Ill.). Feb. 1963. Contract W-31-109-eng-38. 9p.

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Small samples of aluminum-enriched uranium alloy plates submerged in room temperature water were subjected to severe nuclear transients in Treat to determine the extent of metal water reaction and to observe the physical changes that occurred. A standard SPERT 1-D type fuel plate was used for one of the tests. The extent of reaction was determined by measuring the hydrogen evolved. Metallographic examinations indicated an increase in porosity with increased energy input. Large spherical pores were formed indicating the accumulation of gas. Results are graphically shown. (N.W.R.)

35085 (CVNA-147) THE NUCLEAR DESIGN OF THE CVTR CORE. Herbert C. Hecker, Jr. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). July 1962. For Carolinas Virginia Nuclear Power Associates, Inc., Parr, S. C. Contract AT(30-1)-2289. 144p.

This report describes the nuclear characteristics of the initial core loading for the power plant of the Carolinas Virginia Nuclear Power Associates, Inc. These include core reactivity, control rod worths and power distributions, and reactivity coefficients. In addition to operating characteristics, parameters for the cold and hot zero power cores are obtained for comparison with startup experiment data. (auth)

35086 (DP-832) ANALYSIS OF THE SUBSTITUTION TECHNIQUE FOR THE DETERMINATION OF D_2O LATTICE BUCKLINGS. William E. Graves (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). June 1963. Contract AT(07-2)-1. 30p.

Three methods of analysis for the substitution experiments were tested against experiment: a one-group, three-region perturbation method; a two-group, two-region diffusion theory method; and a two-group, three-region diffusion theory method. It was found that the one-group perturbation method worked well over the full range of the experiments to which it was applied. The two-group, two-region method worked well when diffusion coefficient mismatches were the main problem, but broke down when there was a bad mismatch in resonance escape probability. The two-group, three-region method worked well, but did not offer any advantage over the one-group perturbation method to justify its greater complexity. (auth)

35087 (DP-833) EFFICACY OF EXPERIMENTAL PHYSICS STUDIES ON HEAVY WATER LATTICES. John L. Crandall (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). July 1963. Contract AT(07-2)-1. 61p.

The requirements, methods, and accuracy of experimental physics studies performed on heavy water reactor lattices are reviewed. The review is extensively illustrated with examples taken from heavy water power reactor studies at the Savannah River Laboratory. 84 references. (auth)

35088 (EUR-221.e) THEORETICAL FOUNDATIONS OF PARAMETER OSCILLATION MEASUREMENTS. G. Blaesser (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 18p.

The influence of periodic changes of some localized reactor parameters (cross sections) on the output signal of a detector placed somewhere in the reactor is discussed from a general point of view. For the special case of thermal reactors, a procedure of determining independently the contributions of the absorption and production of neutrons to these oscillations is given. (auth)

35089 (EUR-283.i) IL PROGRAMMA MUFT-EUR PER IL CALCOLO DELLE COSTANTI EPITERMICHE. (The MUFT-EUR Program for Calculating Epithermal Constants). I. Galligani (Milan. Università. Istituto di Fisica Teorica). 1963. 104p.

The program MUFT-EUR, in Fortran Monitor for the IBM 7090, calculates resonance escape probability. Unresolved as well as resolved resonances are taken into account, along with self-shielding in rods and mutual shielding in rod lattices. For resolved resonances a distinction between broad and narrow resonances is made. The Doppler effect can be included or excluded, and the library includes resonance parameters of common absorbing elements. A sample problem is shown. (D.C.W.)

35090 (EUR-305.e) FAST NEUTRON SPECTRUM IN ORGEL TYPE REACTORS. L. Amyot (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 17p.

In Spinrad's theory, the fast fission factor is defined in terms of three spectral types of fast neutrons: the epithreshold fission spectrum, the subthreshold fission spectrum, and the inelastically scattered subthreshold spectrum. To allow direct comparison with numerical multigroup calculations, it is convenient to divide the fast neutrons merely on the basis of energy into two groups lying on either side of the fission threshold. For ORGEL-type lattices, the results of DSN problems run with eighteen quarter-lethargy subgroups showed that the neutrons in the top energy group correspond fairly well to Spinrad's first spectral type. However, below the fission threshold, the combined effect of in-group inelastic scattering by U^{238} and elastic scattering by hydrogen yields a relatively flat spectrum. The cross sections of interest in the definition of the

fast fission factor were evaluated with the DSN spectra, an epithreshold fission spectrum and a sub-threshold flat spectrum, Spinrad's three spectral types. Finally, the effect on ϵ of the uncertainties in the fast neutron cross sections was estimated and compared with the effect due to a change in the assumed spectrum. (auth)

35091 (EUR-360.i) PROBLEMI DI CALCOLO DELL'ASSORBIMENTO DI RISONANZA NEI REATTORI NUCLEARI. (Calculation Problems for Resonance Absorption in Nuclear Reactors). B. Coppi and M. Francesio (Milan. Università. Istituto di Fisica Teorica). 1963. 162p.

The traditional methods and calculation techniques for resonance absorption in nuclear reactors are recalled. The presentation is largely based on Dresner's work. Resonance absorption in heterogeneous medium was treated in a completely different way. Formulas that are frequently used in relation with resonance escape probability in heterogeneous media were obtained. Possible alterations to the nuclear codes of MUFT in the calculations of the resonance escape probability factor are suggested. (auth)

35092 (EURAEC-612) AN ADVANCED RESEARCH PROGRAM ON THE APPLICATION OF STEAM–WATER SPRAY TO THE COOLING OF LIGHT WATER REACTORS. CAN-2 Quarterly Progress Report No. 7, January 1 to March 31, 1963. (Centro Informazioni Studi Esperienze, Milan). Apr. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 060-61-7-RDI. 16p. (CISE-R-76)

Heat transfer experiments were mainly devoted to critical heat flux measurements. The effect of non-uniform power distribution was found to have no influence on the total critical power. The influence on burnout was studied of inlet and outlet flow conditions. Tests with cluster geometry were initiated. Hydrodynamic studies were pursued with the adiabatic loop at room temperature. Experiments were performed to measure shear stresses on the duct-wall and mean densities of the two-phase mixtures. Liquid film flow rates were measured by means of the specially developed extraction probe. Long exposure tests with Zircaloy-2 samples were completed. Data interpretation is being presently carried out. Corrosion tests with controlled oxygen content are still in progress. A new set of corrosion tests was initiated to investigate the influence of specific mass flow rate. (auth)

35093 (EURAEC-622) DEVELOPMENT PROGRAM ON THE APPLICATION OF STEAM–WATER SPRAY TO REACTOR COOLING. CAN-3 Quarterly Progress Report No. 5, January 1 to March 31, 1963. (Centro Informazioni Studi Esperienze, Milan). Work Performed under United States–Euratom Joint Research and Development Program. Contract 056-62-1-RDI. 11p. (CISE-R-77)

After completion of the preliminary operation tests of the Genova heat transfer and hydrodynamics loop, experiments were started with a first tubular test element. The in-pile loop at Saluggia operated for about 240 hours in order to carry out radiolysis experiments. Hydrogen production was found to be about 10 times highre than in absence of radiation, when hydrogen originates from corrosion only. Out-of-pile dynamic and static corrosion tests were also performed with Zircaloy-2 specimens. (auth)

35094 (EURAEC-702) A NEW APPROACH ON ENGINEERING HOT CHANNEL AND HOT SPOT STATISTICAL ANALYSIS. U. L. Businaro and G. P. Pozzi (FIAT. Sezione Energia Nucleare, Turin). May 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 035-60-11RDI. 76p. (FN-E-35)

Several attempts have been done by various authors to introduce the methods of statistical analysis in the calculation of correction factors due to fabrication tolerances (engineering hot channel factors); a generalized statistical approach is described. A nuclear core is physically defined by a certain number of independent variables (x_i), which define core geometry and material characteristics: for example, fuel density and enrichment, fuel radius, cladding internal and external radius. These x_i's variables are subjected to statistical variations from point to point in the core. On designing a reactor, one is faced with the problem of determining certain thermal and hydraulic dependent variables $Y = f(x_i, \ldots, x_i, \ldots)$. In the present work, account is taken of the fact that the thermal and hydraulic variables Y's depend: a) on local values of the x_i's; b) on neutron flux spatial distribution and on the entire reactor thermal and hydraulic conditions. To do this a geometrical core model was developed. This model, called "spot model," considers each fuel channel as divided in small regions: in each of these small regions the x_i's may be assumed constant and their actual values are chosen at random (independently one from the other, and in an independent way from region to region) according to their experimental distribution curves due to fabrication tolerances. Having represented in this way an "actual" core, it is possible, with the aid of a detailed thermal and hydraulic calculation routine, to evaluate the Y variables relative to such a core. This procedure is repeated according to a Monte Carlo technique, choosing at random as many "random cores" as necessary. In this way actual probability and distribution curves for the Y are obtained. By intersection of the distribution curves with a certain confidence level the expected Y^+ values are obtained. This procedure was programmed on an IBM-7090 computer. The code, named HYTHEST, evaluates the correction factors relative to a PWR or a BWR reactor core. The first results obtained can be summarized: a) the most probable values of the Y's do not always correspond to the nominal values: the deviations are stronger for highly non-linearly dependent variables (e.g. maximum fuel temperature); b) the distribution curves of the Y's depend from the assumed neutron flux shapes: so, for instance, the exit enthalpy variations are larger, if the axial flux shape is more peaked; c) the correction factors obtained with the "spot model" statistical approach are generally smaller by an order of magnitude than that given by the corresponding conservative method: however, this rule does not hold for some non-linearly dependent variables. A detailed comparison between the conservative method and the "spot" model was made. (auth)

35095 (GEAP-4140) DEPOSITION OF MATTER FROM A FLOWING STREAM. I. GENERAL RELATIONS AND EQUATIONS. Leo F. Epstein and Thomas F. Evans (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Dec. 1, 1962. Contract AT(04-3)-189. 52p.

The contamination of system components by radioactive species carried in the coolant of a nuclear reactor can cause problems in accessibility and maintenance. To examine this question, a physical model was formulated in which the deposition process is determined by mass transfer considerations and an adsorption-desorption mechanism. The bulk concentration of the contaminant in the fluid and the surface concentration on the walls are obtained as the solutions to two simultaneous partial differential equations, in distance and time; and these solutions come out in terms

of an integral involving Bessel functions of a purely imaginary argument. Tables for convenient evaluation of these functions are presented. The physical factors which determine the values of the parameters of this problem, and how they can be evaluated or estimated, are discussed in detail. (auth)

35096 (GEAP-4141) DEPOSITION OF MATTER FROM A FLOWING STREAM. II. APPLICATION TO A RADIOACTIVE SUPERHEATED STEAM SYSTEM. Thomas F. Evans (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Dec. 1, 1962. Contract AT(04-3)-189. 54p.

The deposition of radioactivity on metal coupons and system walls from steam which was nuclearly superheated in the Vallecitos Boiling Water Reactor was studied. The principal radioisotopes observed, both in the presence and absence of fission products, are identified, their sources discussed, and their relative importances in the determination of system radiation levels assessed. The amounts of radioactive deposit on a variety of materials were studied and related to the corresponding concentrations of radioactive species present in the steam. The data are interpreted in terms of the deposition theory developed in a companion paper, and are utilized to evaluate parameters which describe mass transfer and adsorption-desorption processes considered in the physical model. Related data from the literature are used to extend the application of the theory and values obtained are compared with those from the current tests. Extensive tables of data and summaries are included. (auth)

35097 (GEAP-4214) SODIUM-COOLED REACTORS PROGRAM. FAST CERAMIC REACTOR DEVELOPMENT PROGRAM. Sixth Quarterly Report, January–March 1963. F. J. Leitz, ed. (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Apr. 1963. Contract AT(04-3)-189. 76p.

Progress is reported on the development of the Fast Ceramic Reactor. Information is reported on vented fuel development, fuel testing in TREAT, fuel fabrication development, fast-flux fuel irradiations, and reactor dynamics and design. (N.W.R.)

35098 (GEAP-4304) IN-CORE INSTRUMENTATION DEVELOPMENT PROGRAM. DETECTORS FOR IN-CORE POWER MONITORING. R. A. DuBridge (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). June 1963. Contract AT(04-3)-189. 65p.

The development progress made in improving detectors for operating up to 1000°F for in-core power monitoring is summarized. Normally, at high neutron fluxes, the d-c current is measured from an ion chamber. D-c measurements are range limited due to d-c leakage and gamma interference. The range of neutron flux measurement can be greatly increased by measuring the root mean square fluctuation voltage. This method discriminates against gamma and avoids the d-c leakage problem. This means fully enriched chambers are capable of a much greater range of measurement. It also means low enrichment uranium can be used to take advantage of plutonium buildup, threshold fissionable materials can be used, and chambers can be operated at high temperatures. Thermocouple-type detectors developed for in-core power monitoring have a smaller range and longer time response but does have advantages of system simplicity and application at very high temperatures. (N.W.R.)

35099 (GNEC-288) NUCLEAR SUPERHEAT DEVELOPMENT PROGRAM. DESIGN, FABRICATION AND IRRADIATION TEST OF A DOUBLE-ANNULAR BOILING-SUPERHEATING FUEL ELEMENT. S. J. Weems, S. E. Turner, J. S. Wiley (General Nuclear Engineering Corp., Dunedin, Fla.); H. Lichtenberger, and D. E. Nulk (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). June 28, 1963. Contract AT(11-1)-795. 93p.

The experimental fuel element for the in-pile test is a shortened version of the outer annulus section (about 1.5-in. OD by 1-in. ID) of the double-annular combination boiling-superheating fuel element of the type used in the reference design of the NUSU 200-Mw(e) power plant. The external clad for this outer annular section is 0.028-in.-thick type 347 stainless steel in direct contact with the boiling-water moderator; the internal clad is 0.025-in.-thick Inconel-X tubing which is in contact with superheated steam. The fabrication test activity was directed at the production of an adequate end closure for the outer and inner cladding tubes. The preparation of a welded end closure produced satisfactory results. The thermal cycle test work consisted of electrically heating and thermally cycling the inner cladding in air between about 700 and 1320°F while maintaining the outer cladding at about 600°F in a liquid metal environment. This test activity was terminated after the last test fuel element had successfully withstood 825 thermal cycles. The in-pile test, while of relatively short duration (total reactor exposure was 42 days, maximum fuel burnup was about 750 Mwd/t U), was conducted under severe conditions. Although the experimental fuel element was subjected to extensive thermal cycling during the in-pile test, no excessive damage or distortion was found. There were 20 scrams from power levels with high clad temperatures, and there were numerous power level changes. During the in-pile test, the Inconel-X was hardened, and therefore strengthened, in regions where the high operating temperatures would have otherwise caused a reduction of strength. This strength enhancement, caused by age hardening at temperatures around 1300°F, resulted in a more uniform distribution of strain during thermal cycling. Corrosion of the steam-cooled Inconel-X was limited to a uniform scale about 0.8-μ thick with no evidence of localized corrosion or cracking. However, during the latter part of the irradiation test, the activity of the steam coolant was measurably higher downstream of the fuel element. This higher downstream activity can be satisfactorily explained by either or both of two mechanisms; the test fuel element may have lost cladding integrity, or there may have been water in-leakage from the reactor moderator. The amount of water in-leakage increased (as measured by Na^{24} throughput) at the same time the downstream activity increased above the upstream activity. Post-irradiation leak tests yielded no indication of a cladding leak. Visual and metallographic examinations showed no indication that the cladding had undergone any significant damage which might have resulted in a failure. It was concluded that the feasibility of the NUSU fuel element concept is demonstrated, at least for short term irradiation. Evidence to date indicates that use of such fuel elements could significantly decrease both the capital and fuel cycle costs of nuclear power reactors. (auth)

35100 (LAMS-2920) RAC—A COMPUTER PROGRAM FOR REACTOR ACCIDENT CALCULATIONS. Curtis G. Chezem and William R. Stratton (Los Alamos Scientific Lab., N. Mex.). Jan. 1963. Contract W-7405-eng-36. 75p.

The RAC program, in Fortran for an IBM 7090, describes the behavior of a graphite–uranium loaded reactor core in

space and time during a power excursion. For calculational purposes, the core is assumed homogeneous and divided into an arbitrary number of squat, adjacent cylinders with a fixed relative flux distribution assigned to each such region. Given an assumption on the imposed reactivity above prompt critical the code cyclically generates fission energy, temperature and pressure in each region. A measure of the kinetic or explosive energy of the reactor transient is eventually obtained. The mathematical formulation, operation and complete computer listings are included. (auth)

35101 (MITNE-35) SUMMARY REPORT ON HEAVY WATER, NATURAL URANIUM LATTICE RESEARCH. I. Kaplan, D. D. Lanning, A. E. Profio, and T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). July 9, 1963. Contract AT(30-1)-2344. 63p. (NYO-10209)

The nuclear properties of subcritical lattices of partially enriched uranium rods in heavy water are experimentally and theoretically investigated. The measurement methods discussed are being improved where possible and are presently being applied to lattices of 0.25-inch diameter rods of uranium containing 1.03% uranium-235 at different lattice spacings. In addition to the steady-state methods described, pulsed-neutron studies of reactivity were started. Studies are being continued, in the small subcritical assembly, on miniature lattices of 0.25-inch diameter rods containing 1.143% uranium-235. Two-region exponential experiments with the slightly enriched uranium rods are under way. Investigations of neutron distributions in and around single rods of 1.0-inch diameter, natural uranium rods are in progress. Theoretical methods are being applied to lattices of slightly enriched rods, extended where necessary to handle tighter lattices of small diameter rods. When data are obtained over a wider range of enrichments, diameters, and volume ratios, an overall study of the theory of heavy water lattices will be made. (N.W.R.)

35102 (NAA-SR-8225) POISON MIXTURES WHICH IMPROVE THERMAL REACTOR OPERATING CHARACTERISTICS. J. H. Bick (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 30, 1963. Contract AT(11-1)-Gen-8. 22p.

A theoretical investigation was made regarding the effect of binary poison mixtures on the temperature defect and temperature coefficient in a simple reactor model. The poison mixtures investigated were gadolinium–erbium, gadolinium–europium, europium–erbium, and europium–cadmium. It was found that, in this model, the magnitude of the negative temperature coefficient could be increased and the temperature defect could be decreased simultaneously. Calculations using an actual reactor showed that the addition of a selected binary poison mixture would decrease the temperature defect without changing the temperature coefficient. (auth)

35103 (NAA-SR-Memo-2658) PERMISSIBLE FUEL HEAT GENERATION RATES FOR OMRE SHIPPING CASK. R. C. Noyes (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Apr. 14, 1958. Contract AT(11-1)-Gen-8. 10p.

The permissible heat generation rates are 0.378 kw/element for an air filled cask and 0.540 kw/element for a helium filled cask. These heat generation rates are based on the following assumptions: axial peak/average heat generation = 1.4, effective radial (within the element) peak/average heat generation = 1.3, heat removal efficiency of the end plates = 80%, and maximum fuel plate temperature must be less than 500°F. No safety factor is included in the calculation. A method is established by which the necessary delay time before insertion in the cask is established for a given fuel element. (N.W.R.)

35104 (NAA-SR-Memo-3034) PRELIMINARY HEAT TRANSFER AND COOLING STUDIES FOR FUEL TRANSFER OPERATIONS. J. T. Ream (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 1, 1958. Contract AT(11-1)-Gen-8. 33p.

A preliminary heat transfer and cooling analysis of the HNPF fuel elements during transfer operations with the fuel handling cask is conducted. Operating power level and irradiation time are considered as independent parameters. The following are determined: limiting temperatures; temperature gradients of fuel elements; temperatures in fuel, cladding, spacers, and cask; minimum decay time before first elements can be removed without exceeding specified steady-state temperature and stress limits without forced cooling; and factors which affect cooling time to the highest degree such as geometry, power level, operating time, and fuel. (N.W.R.)

35105 (STL-6303) PRELIMINARY RESULTS OF IN-PILE CAPSULE EXPERIMENTS IN THE KEWB REACTOR. Quarterly Progress Report for Period Ending March 31, 1963. L. B. Wentz and S. M. Zivi (Space Technology Labs., Inc., Redondo Beach, Calif.). Apr. 15, 1963. Contract AT(04-3)-372. 21p.

Measurements were made of transient steam formation in capsule experiments in the KEWB reactor. Measurements of volume changes due to nonboiling phenomena are interpreted. Data on transient steam formation are presented for some runs with a fuel disk enriched to about 48% U^{235}. Simultaneous measurements of steam-void volume, pressure, fuel disk surface temperature, and KEWB reactor power are shown in graphs. The measured surface temperature histories were compared with the saturation temperature histories that were obtained from the measured pressures. High-speed motion pictures showed that bubble nucleation occurs first in one local region of the surface and then propagates rapidly to cover the complete surface. (M.C.G.)

35106 (TID-3525(Rev.5)) REACTOR SAFETY. A Literature Search. Richard J. Smith, comp. (Division of Technical Information Extension, AEC). Mar. 1963. 134p.

A total of 1906 references to unclassified reports and published literature is presented on reactor systems, materials, and operation designed to provide maximum safety for the reactor, reactor personnel, and environs. Information is included concerning incidents and conditions of operation considered hazardous. Author, reactor, and report number indexes are provided. (auth)

35107 (WAPD-T-1571) NON-CELL CORRECTION TO THIN CELL HOMOGENIZATION. N. R. Candelore and R. C. Gast (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). May 1, 1963. Contract AT(11-1)-Gen-14. 12p. (CONF-39-56)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

A common calculational procedure for reactors with fuel regions composed of thin cells, such as fuel regions made of a uniform array of fuel plates and moderator channels, is to represent such regions with homogenized constants. This procedure is desired in transport theory as well as in any order of approximation, such as diffusion theory, in order to avoid explicit representation of many fuel plates and moderator channels. These homogenized constants, or their equivalent in terms of energy-dependent homogenized number densities for each isotope in the fuel region, are commonly obtained through the flux-volume

weighing method. This method consists of representing the fuel region as an infinite array of thin cells or subcells, i.e., a fuel plate between two half moderator channels with symmetry boundary conditions on the outside boundaries. An energy-dependent transport solution is obtained for this subcell and the spatial flux solution at each energy is used to flux-volume weight cross sections or number densities. Thus, at each energy the flux-volume weighted constants will give absorption rates in a homogenized medium equal to those of the subcell for the same integrated flux over space. (N.W.R.)

35108 (WAPD-T-1601) RECENT PROGRESS IN REACTOR KINETICS AT THE BETTIS LABORATORY. J. N. Grace (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Apr. 1963. Contract AT(11-1)-Gen-14. 27p. (CONF-156-1)

From Symposium on Reactor Kinetics and Control, Tucson, Ariz., Mar. 1963.

Four different topics in reactor kinetics are discussed. First, some recent work on operator-induced oscillations in axial xenon and power distribution is described. The second topic is methods of analysis of hydrodynamic instability in parallel channels. The third is heat transfer behavior during exponential power transients. Finally, a discussion is given on reactor self-shutdown capability when chemical poisons are dissolved in the moderator. Only the highlights and conclusions of these studies are described. (N.W.R.)

35109 (WCAP-3711) THE HETEROGENEOUS REPRESENTATION OF CONTROL RODS IN LIGHT WATER LATTICES: A COMPARISON OF ANALYSIS AND EXPERIMENT. W. J. Eich and H. T. Williams, Jr. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). [1962]. Includes Appendices: A. DISCUSSION OF THE COMPARISON BETWEEN MULTI-GROUP AND FEW-GROUP ANALYSIS IN THE EPITHERMAL REPRESENTATION OF A SLAB ABSORBER. H. Aisu. B. SOME PROCEDURES BASED ON CORRELATIONS DESCRIBED IN THIS REPORT. C. TABLES OF NUMERICAL DETAILS OF THE ANALYSIS. Contract AT(30-1)-3064. 97p.

The Bettis-developed scheme for the explicit representation of cruciform control rods in four groups was applied to two basically different types of core configurations. The net result was the replacement of a semi-empirical two-group scheme of control-rod representation utilized previously by a four-group analytic scheme which is generally applicable to water-moderated and -cooled and low-enriched cores. Additionally, explicit procedures were developed for use in the preparation of two-group analyses so that their eigenvalues will closely approximate four-group results. Finally, the analyses of two types of cores, batch-loaded and multi-region, underlined the precedence of improvement in one particular aspect of the basic calculational scheme before further progress would be possible in control-rod representation as such. (auth)

35110 A NEW ANALYTIC METHOD FOR THE SOLUTION OF TWO-DIMENSIONAL MULTIREGION REACTOR THEORY. Fumio Amano. Denki Shikensho Iho, 27: 135-44(Feb. 1963). (In Japanese)

A new analytic method for the solution of two-dimensional (r,z) multigroup multiregion problems is described. The solutions are gained by expanding each of the fluxes in a double series of eigenfunctions valid over the entire reactor, without the requirement that fluxes and currents be continuous at the interfaces in the conventional nuclear reactor theory. The eigenfunctions used are solutions of a two-dimensional Helmholtz equation that vanish at the outer boundary of the reactor. Finally, by applying this theory to a particular reactor, in which a cylindrical core is surrounded by cylindrical reflector symmetrically, the relations between the eigenvalue of the criticality equation and the number of modes of neutron flux are examined. (auth)

35111 METALLIC CANNING AND STRUCTURAL MATERIALS FOR REACTORS. F. Sperner (W. C. Heraeus GmbH, Hanau, Ger.). Kerntechnik, 5: 303-6(July 1963). (In German)

The essential problems as to the choice of canning and structural materials for reactors, as well as the most important mechanical, physical, and chemical properties of the material to be used, are discussed. Because of the low thermal-neutron absorption cross section formerly required, only a few groups of alloys could be considered. Increasing operation temperatures and thereby increasing demands for high-temperature strength and better corrosion resistance have also made material with higher thermal-neutron absorption cross section more interesting. For fast reactors, the neutron-absorption cross section is not of such a decisive part. As to the construction of reactor tanks, problems of welding and corrosion have to be solved. Thus, problems of corrosion resistance for the construction of containers with liquid metals as coolant and especially for those running with liquid salts as fuel, raise considerable difficulties. (auth)

35112 AUTOMATIC NONBREAK EMERGENCY SETS FOR NUCLEAR POWER REACTORS. H. Zirden (Motoren-Werke, Mannheim AG, Ger.). Kerntechnik, 5: 307-8 (July 1963). (In German)

Automatic nonbreak emergency type Diesel sets are required for the supply of energy to maintain the circuit of the cooling agent for the heat remainder still contained in the core after disconnection of the reactor due to failure of the main supply. Furthermore, such nonbreak emergency sets warrant continuous operation of air-conditioning, sluice chambers, experimental devices, and lightings. Thus, the safety of operation of the complete reactor plant depends to an extremely large extent on the nonbreak emergency sets. (auth)

35113 REACTOR CONTAINMENT RESEARCH AND DEVELOPMENT. N. A. Weil (Illinois Inst. of Tech., Chicago). Nucl. News, 6: No. 8, 13-18(Aug. 1963).

Current assumptions on the possible causes and severity of reactor accidents are presented, and areas in which research on the economically important containment problem is needed are discussed. Sources of energy in a major accident and concepts of standard containment, pressure relief, pressure suppression, and total low-pressure containment are considered. The rate of energy release, response of containment structure, structural damage from flying fragments, and leakage rates of fission products are also discussed. (C.E.S.)

35114 EFFECTS OF CHANGING ECONOMIC CONDITIONS ON FUEL-CYCLE COSTS. Paul Dragoumis (American Electric Power Service Corp., New York), Manson Benedict, Henri Fenech, Max C. Richardson, and Donald L. Trapp. Nucleonics, 21: No. 8, 116-19(Aug. 1963).

The effects on pressurized-water-reactor fuel-cycle costs of private ownership of nuclear fuel and of other changing economic conditions are computed and evaluated. A variety of ownership, handling, and processing arrangements are considered, and an equation for the fuel-cycle cost is demonstrated. (D.C.W.)

35115 DIFFUSION STUDIES IN DISPERSION-TYPE FUELS. F. J. Stubbs (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Brit. Ceram. Soc., 62: 257-68(Mar. 1963).

By reference to a fission-yield curve, fission products of greatest importance in the operation of possible new reactor systems having ceramic fuel elements in direct contact with the coolant gas are shown. Methods developed in the Chemistry Division at Harwell are reviewed for studying the emission of fission-product gases (isotopes of krypton and xenon) from potential fuel-element materials. $BeO-UO_2$ ceramics of high density showed great retention of fission gases; $UO_2-Al_2O_3-SiO_2$ ceramics showed good retentivity as did sintered UO_2 but, with the latter, oxygen caused a marked diminution in retentivity. A UO_2-MgO ceramic (80% theoretical density) had given off nearly all the fission gases at 800°C. (auth)

35116 MONTE CARLO CALCULATION OF THE NUCLEAR TEMPERATURE COEFFICIENT IN FAST REACTORS. W. Matthes (Euratom, Ispra, Italy). 28p. (CONF-139-1; EUR-309.e)

From Third Symposium on Reactor Theory, Bad Nauheim, Ger., Apr. 1963.

A Monte Carlo program for the calculation of the nuclear temperature coefficient for fast reactors is described. The special difficulties for this problem are the energy and space dependence of the cross sections and the calculation of differential effects. These difficulties are discussed in detail and the way for their solution chosen in this program is described. (auth)

35117 FISSION PRODUCT RELEASE DURING MELTDOWN OF ANP INDIRECT CYCLE FUEL ELEMENTS. S. J. Rodgers and J. W. Mausteller (MSA Research Corp., Callery, Penna.). 11p. (CONF-39-31)

From American Nuclear Society Meeting, Salt Lake City, June 1963.

Meltdown tests were performed to determine the degree of fission-product release from indirect-cycle aircraft nuclear propulsion fuel pins. Techniques were developed for induction heating and melting of the pins and for containing the molten fuel for times as long as twenty minutes in atmospheres of helium and air–alkali metal vapor. Fission-product release from fuel pins irradiated to an integrated thermal flux of approximately 7×10^{15} nvt was determined for 2 and 20 minutes melts at the fuel melting point and at 5500°F. The release of Xe^{133}, I^{131}, Te^{132}, Cs^{137}, Ba^{140}, Sr^{90}, Y^{91}, Ce^{141}, beryllium, and uranium was measured quantitatively, and the size distribution of released particles was determined. Fission product release in air–alkali metal vapor over the temperature range of investigation varied from 50 to 100% of the volatiles (Xe^{133}, I^{131}, Te^{132}, Cs^{137}) and 0.2 to 10% of the nonvolatiles (Sr^{90}, Ba^{140}, Y^{91}, Ce^{141}, uranium, and beryllium). (auth)

35118 CONCRETE REACTOR CONTAINMENT. Ralph F. Lumb, William F. Hall, and Jacob Fruchtbaum (Western New York Nuclear Research Center Inc.). 6p. (CONF-39-18)

From American Nuclear Society Meeting, Salt Lake City, June 1963.

The results of various leak-rate tests demonstrate the practicality of concrete as primary containment for the maximum credible accident for a research reactor employing plate-type fuel and having a power in excess of one megawatt. Leak-test time was shortened substantially by measuring the relaxation time for overpressure decay, which is a function of leak rate. (auth)

35119 MIGRATION AREA IN SLIGHTLY-ENRICHED-UO_2 LIGHT-WATER-MODERATED LATTICES. M. Imai, T. Kanai, and H. Kobayashi (Hitachi Ltd., Tokyo). 3p. (CONF-39-74)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Migration areas are calculated from a one-group critical equation, using experimental variations of buckling coefficients with lattice size. The assembly is a fully reflected, slightly enriched-UO_2-pin-fueled, light-water-moderated facility. Buckling values are tabulated for cylindrical, rectangular, and parallelepipedal core geometries. (T.F.H.)

35120 FUEL ELEMENT LATTICE FOR HETEROGENEOUS NUCLEAR REACTORS CONTROLLED BY CONTROL RODS. Arno Mueller (to Deutsche Babcock and Wilcox-Dampfkesselwerke Aktienges). German Patent 1,149,466. May 30, 1963. Filed Sept. 27, 1961.

The lattice structure of the core of a heterogeneous nuclear reactor is described in which the fuel elements and the control rods are arranged in a two-dimensional rod lattice. While the control rods are disposed so that their center of mass is exactly in lattice points the center of mass of the fuel elements is placed away from the lattice points in the direction of the next control rod. This arrangement results in the neutron flux remaining uniform throughout the core when the control rods are removed. (Gmelin Inst.)

35121 APPLICATION OF HYDRATE OF ACTINIDES SOLS AS NUCLEAR FUEL. Th. L. O'Connor, Walter Juda, P. H. McNally, and Norman W. Rosenberg (to Diamond Alkali Comp.). German Patent 1,149,830. June 6, 1963. Priority date June 19, 1958, United States.

The fluid fuel described, which contains watery sols of hydrated oxides or hydroxides of actinides, is heat and radiation resistant, noncorrosive, remains well dispersed throughout the reactor system, and contains only elements with a low neutron absorbing cross section. This fuel is composed of a hydrate of actinides that has a particle size of 10 to 200 mμ preferably 10 to 100 mμ. At least 80% of the particles must have a diameter that does not deviate more than 30% from the average particle diameter. (Gmelin Inst.)

35122 TUBE SYSTEM FOR REMOVING THE HEAT FROM NUCLEAR REACTORS. B. Vrillon and R. Roche (to Commissariat à l'Energie Atomique). German Patent 1,149,831. June 6, 1963. Priority date June 4, 1959, France.

A tube system for removing the heat from nuclear reactors is described which is provided with header means for distributing fluid coolant medium to or receiving fluid medium from the tubes disposed within the core. Outside the reactor core but next to the core the tubes are covered on the inside with insulation against loss of heat and are provided with means for cooling the outside. (Gmelin Inst.)

35123 ARRANGEMENT OF CONTROL RODS WITHIN THE CORE OF A NUCLEAR REACTOR. Wolfgang Junkermann (to Deutsche Babcock and Wilcox–Dampfkesselwerke AG). German Patent 1,150,765. July 27, 1963. Filed Apr. 22, 1960.

The lattice structure of a nuclear reactor core is described in which the fuel elements are disposed in parallel rows so that they are arranged in a two-dimensional primitive cubical lattice. The control rods which are located at interstitial lattice points are arranged in a face-centered two-dimensional cubical lattice, the translation vectors being four-times as large as the translation vectors of the

fuel element lattice. This lattice arrangement is supposed to yield a uniform distribution of the neutron flux. (Gmelin Inst.)

35124 COOLANT SYSTEM FOR NUCLEAR PRESSURE TUBE REACTORS. W. Keller, Hans-Peter Schabert, P. Eibert, and H. Sandner (to Siemens-Schuckertwerke AG). German Patent 1,151,073. June 14, 1963. Filed Dec. 2, 1961.

The coolant system described is for removing fission product heat arising from the fuel elements in the core structure of a shut-down gas-cooled pressure tube reactor on cessation of forced circulation between reactor and heat exchangers. The nuclear reactor is provided with header means for distributing the fluid to or receiving fluid from the pressure tubes. The primary coolant circuit is further provided with heat exchangers and blowers. The ducts connecting the blowers with the header means for distributing the fluid as well as the ducts connecting the header means for receiving the fluid with the heat exchangers communicate permanently with each other via particular ducts. (Gmelin Inst.)

35125 HYDRAULIC CONTROL ROD DRIVE MECHANISM. Hermann Kumpf (to Siemens-Schuckertwerke AG). German Patent 1,151,607. July 18, 1963. Filed July 12, 1961.

The hydraulic control rod drive mechanism described is housed in a thimble attached to and extending outward from the reactor vessel. The drive mechanism uses reactor coolant medium as the hydraulic fluid. Within the housing there are two concentrically arranged hollow, cylindrically shaped members to one of which the piston is attached. One of the two members is provided with radial perforations located in axial direction along a screw-like line. The other member has radially directed perforations that are situated in a plane normal to the axis. Through the perforations of the members reactor coolant medium flows from one part of the reactor vessel to the other forced by the pressure difference between them. Axial movement of the control element is achieved by turning one of the members relative to the other or by locking the perforations successively with the help of a sliding valve. The described mechanism is very crude and insensitive to dirt. (Gmelin Inst.)

35126 ROD-LIKE CONTROL ELEMENT FOR NUCLEAR REACTORS. Karl Janner (to Siemens-Schuckertwerke AG). German Patent 1,151,608. July 18, 1963. Filed Aug. 18, 1961.

A rod-like control element for nuclear reactors is described which obviates the complications attending the use of long rods in that the neutron balance of the reactor can be influenced by very small travel of the element members. This control element consists of a fixed member that has zones filled with fissionable material, alternating with zones through which moderator or coolant medium is flowing. This fixed member surrounds a further member the latter being movable longitudinally relative to the fixed member. The inner member is subdivided into zones that are practically equal in length and are filled with neutron-absorbing material alternating with zones that contain fissionable material. The zones of the fixed member that contain fissionable material are covered on the inside with a layer of neutron-absorbing material. This control element can also be used as a fuel element at a normal lattice position. (auth)

35127 STEAM COOLED REACTOR AND FUEL CHANNEL. Stefan George Bauer and Norman Battle (to Rolls-Royce Ltd.). U. S. Patent 3,099,616. July 30, 1963. Priority date Aug. 6, 1958, Great Britain.

A fuel channel composed of a thin stainless steel tube surrounded by a concentric aluminum alloy tube, the space between being filled with an insulating gas such as carbon dioxide or helium at a pressure substantially equal to the pressure within the inner tube is presented. This construction is particularly adapted for a steam-cooled heavy-water moderated reactor. (C.E.S.)

Power Reactors

Refer also to abstracts 33420 and 35223.

35128 (ACNP-62031) PATHFINDER ATOMIC POWER PLANT. REACTOR INTERNAL COMPONENTS. D. R. Bruesewitz, J. F. Wilson, E. C. Rothen, D. J. Nolan, J. F. Patterson, and S. P. Wnuk (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). June 28, 1963. For Northern States Power Co., Minneapolis and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. 179p.

Major reactor internal components, test programs related to component development, and methods used in component design analysis for the Pathfinder Reactor are described. The components described include: boiler core grid plate, boiler core shroud, fuel element hold-down assembly, steam dryer assembly, steam separator support shelf, and nuclear superheater. (M.C.G.)

35129 (AGN-TM-402) ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. INITIAL FULL POWER AND LIMITED ENDURANCE TESTS OF THE ML-1 NUCLEAR POWER PLANT. Final Test Report. N. Kattchee (Aerojet-General Nucleonics, San Ramon, Calif.). July 1963. Contract AT(10-1)-880. 90p.

The evaluation of the data generated during the full power and limited endurance tests of the ML-1 mobile nuclear power plant indicates that the reactor performs in accordance with the design specifications. During the 101 hr test period, the reactor attained a maximum power of 3.44 Mw(t) and 247 kw(e) was measured at the output shaft of the turbine-compressor set. No operating limits were exceeded during these tests and all systems performed satisfactorily. Except for the known performance deficiency of the turbine-compressor set, which prevented the attainment of design output power, no operational, stability, or control problems were encountered. All test objectives were achieved and the tests were considered completely successful. (auth)

35130 (ANL-6693) THERMAL HYDRAULIC PERFORMANCE CHARACTERISTICS OF EBWR (0 TO 100 Mwt). Michael Petrick and E. A. Spleha (Argonne National Lab., Ill.). May 1963. Contract W-31-109-eng-38. 49p.

The modifications of the EBWR internals for operation at higher power included: redesign of riser, relocation and resizing of feed-water injection ring and inlet nozzle, enclosing the core with a cylindrical shell and providing a tight closure between riser and core, and redesign of the steam-discharge system. The volume fraction of steam voids, recirculation flow rate, subcooling, liquid level, steam carryunder in downcomer, and liquid carryover in effluent stream were determined. Instrumentation included differential pressure probes, Stauschiebe tubes, and thermocouples. Tests indicated that the performance characteristics of the EBWR are governed directly by steam carryunder in the downcomer, liquid carryover in the effluent stream, and, indirectly, by the location of the true water–steam interface in the vessel. (M.C.G.)

35131 (BAW-1164(Vol.I)) NUCLEAR MERCHANT SHIP REACTOR. FINAL SAFEGUARDS REPORT. VOLUME I. DESCRIPTION OF THE NS SAVANNAH. G. E. Kulynych (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). June 1960. Contract AT(30-1)-274. 249p.

A complete description is given of the ship and its power plant with emphasis of the features pertinent to the safe operation of the ship. (D.L.C.)

35132 (BAW-1164(Vol.III)) NUCLEAR MERCHANT SHIP REACTOR. FINAL SAFEGUARDS REPORT. VOLUME III. DEVELOPMENT OF THE NS SAVANNAH OPERATING MANUAL. J. H. MacMillan, ed. (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). July 1960. Contract AT(30-3)-274. 64p.

The development of the operating manual is described briefly. The table of contents of the manual is reproduced. Examples of normal operating procedure (startup), of abnormal operating procedure (loss of all a-c power to the main Bus), and of system detail description (primary system) are given. (D.L.C.)

35133 (BAW-1164(Vol.IV)) NUCLEAR MERCHANT SHIP REACTOR. FINAL SAFEGUARDS REPORT. VOLUME IV. ORGANIZATION AND MANAGEMENT OF OPERATIONS. (States Marine Lines, Inc., New York). Jan. 1960. Contract AT(30-3)-274. 72p.

A description is given of the corporate organization and management of States Marine Lines, Inc., general agent for operation of Savannah, and of the specific organization for the operation of the ship after commissioning. (D.L.C.)

35134 (BAW-1164(Vol. V)) NUCLEAR MERCHANT SHIP REACTOR. FINAL SAFEGUARDS REPORT. VOLUME V. CREW TRAINING. (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). Sept. 1960. Contract AT(30-3)-274. 92p.

A description is given of the special training programs which were conducted for the Senior Deck Officers, Engineer Officers, and other personnel of NS Savannah. (D.L.C.)

35135 (BAW-1164(Vol.VII)) NUCLEAR MERCHANT SHIP REACTOR. FINAL SAFEGUARDS REPORT. VOLUME VII. POWER PLANT ACCIDENTS. G. Richard Thomas, ed. (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). Mar. 1960. Contract AT(30-3)-274. 130p.

Analysis is made of many postulated accidents within the NS Savannah power plant. The accidents include reactivity accidents, mechanical accidents, and miscellaneous accidents. It is concluded that there is no appreciable hazard to the public or the crew even in the event of the maximum credible accident (loss of primary coolant). (D.L.C.)

35136 (BAW-1164(Vol.VIII)) NUCLEAR MERCHANT SHIP REACTOR. FINAL SAFEGUARDS REPORT. VOLUME VIII. SHIP ACCIDENTS. (Sharp (George G.) Inc., New York). June 1960. Contract AT(30-3)-274. 137p.

Analysis is made of potential hazards to the shipboard reactor during operation of the NS Savannah as a commercial vessel. Collision, grounding, fire and explosion, rough weather, flooding and sinking, and salvage are considered in detail. It is concluded that Savannah can be operated in any part of the world without constituting a hazard to the population or to the environment. (D.L.C.)

35137 (CONF-39-48) THE 630A CRITICAL EXPERIMENT: DESCRIPTION AND EXPERIMENTAL RESULTS. G. D. Pincock and R. E. Wood (General Electric Co. Advanced Technology Services, Cincinnati). June 7, 1963. Contract [AT(11-1)-171]. 18p. (TM-63-6-700)

From American Nuclear Society Meeting, Salt Lake City, June 1963.

The 630A reactor is light water-moderated, beryllium-reflected, gas-cooled, and the fuel cartridges consist of multiple-stage, concentric ring, metallic fuel elements containing fully enriched uranium. Boron steel is wrapped around each fuel cartridge to provide additional reactivity control over the 15,000-hr core life at an average operating power of 66 Mw thermal. The reactor is to be used for producing steam for ship propulsion. The critical experiment reactor is studied with regard to power distribution measurements and reactivity measurements. The data obtained are now being used to define major changes to the configuration. (N.W.R.)

35138 (DLCS-3410204) RADIATION LEVELS OF REACTOR COOLANT SYSTEM HEAT EXCHANGERS. Test Evaluation. N. A. Pozuchanics (Duquesne Light Co., Shippingport, Penna.). First Issue, May 17, 1963. Contract AT(11-1)-292. 9p.

Testing of radiation levels of reactor coolant system heat exchangers was performed three times in order to observe any radiation buildup resulting from crud released during the Seed 3-4 refueling operation. The radiation surveys were performed along the length of each heat exchanger at the end of Seed 3 life to obtain initial radiation levels, at the end of the Seed 3-4 refueling operation, and after approximately 150 EFPH on Seed 4. The data obtained do not indicate any significant radiation buildup as a result of the Seed 3-4 refueling operation during the period of time covered by the surveys. The failure to see any increase in radiation level in the data obtained was felt to be due to conducting the surveys at points which were representative of the radiation level in the general area of the heat exchangers and not including contact readings at crud traps which normally indicate large changes in radiation levels. (auth)

35139 (DLCS-5000663) MONTHLY OPERATING REPORT, JUNE 1963. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 40p.

Station operations were conducted in accordance with the requirements of the testing program, maintenance, and system capacity. A safety shutdown occurred when a false high neutron flux signal was introduced into the RPS circuitry by the energization of a NIS recorder. Other incidents occurred which involved a loss of low voltage power supply to the NIS Channel C, the failure of the No. 1 FEDAL monitor cooling water coil, and the failure of the NIS Channel A CIC. Reference water conditions were maintained in the RCS and in the Reactor Plant auxiliary systems. Construction work continued on the Decontamination System. Minor modifications to the HDS were completed during the month with the exception of some operational problems that became apparent during operational testing of the system. (auth)

35140 (GEAP-4215) FUEL CYCLE PROGRAM. A BOILING WATER REACTOR RESEARCH AND DEVELOPMENT PROGRAM. Eleventh Quarterly Progress Report, January–March 1963. C. L. Howard, comp. (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Apr. 5, 1963. Contract AT(04-3)-189. 66p.

Even though VBWR shutdowns were required for location and removal of five failed fuel assemblies (HPD Program), the increase in fuel exposure was good. Fuel exposures will pass the values at which cold worked stainless steel cladding was failing under the HPD Program. Failure of the 0.005-inch cold worked stainless steel clad fuel rods in assembly 8L was traced to strain cycling fatigue. A study

of tapered fuel rods indicates a potential advantage for use of a variable water/fuel ratio along the flow channel. Natural circulation tests in the hydraulic stability loop were conducted over a range of conditions from stable, to oscillatory with exponential decay, to self-sustaining oscillations of constant amplitude, to unstable oscillations with divergent amplitude. The response to impulses in power input shows the effect of the time delay for transporting steam voids up through the riser. The data permit calculation of oscillation frequency, damping coefficient, time lags, and show the magnitude and character of pressure and velocity changes. The data, which have an experimental scatter of ±10% maximum, show that burnout heat flux: decreases with increasing flow up to 2×10^6 lb/hr-ft^2; has a maximum for hydraulic diameter between 0.25 and 0.5 inch; and decreases for pressure increases between 600 to 1400 psi. A correlating equation for the data is given. The data are compared to results of others. Tests of special geometries show that the burnout heat flux: decreases 22 to 50% when the heated rod is within 0.033 inch of the channel wall; is unchanged upstream of a plate-type spacer; decreases 35 to 50% when the rod surface is roughened by sandblasting; is increased 20 to 40% by use of a rough liner. The four-rod test section is operating satisfactorily and 17 critical heat flux data points are obtained at 1000 psia and flows of 0.5, 1.0, and 1.5×10^6 lb/hr-ft^2. In each case the critical heat flux occurred at the exit end and on the side of the rod facing the corner of the channel. The evaluation of film trippers (rough liner) on the unheated channel walls indicates considerable promise for increasing the burnout heat flux limit. The theory of operation is that the liquid film on the unheated wall is sheared off and dispersed, thus adding to the liquid film on the heated rod. Measurements with a heater rod bowed so that it is in contact with the channel wall show that the critical heat flux is decreased by a factor of two or more from values with normal clearance. Temperature measurements on the rod, when operating past the critical heat flux, were in the order of magnitude of 1000°F for heat fluxes of about 500,000–600,000 Btu/hr-ft^2. Chemical analyses for radial variations in isotopic composition within a fuel pellet are nearly completed and are compiled for interpretation. (N.W.R.)

35141 (GEMP-232) DESCRIPTION OF A 19-CELL 630 REACTOR. (General Electric Co. Advanced Technology Services, Cincinnati). Aug. 19, 1963. Contract AT(40-1)-2847. 13p.

The 630 Reactor is a right circular cylinder penetrated by 19 axial tubes which contain the fuel elements and through which passes the primary coolant. The core is light-water moderated and has a 4-inch beryllium reflector. Shim rods are placed at the interstices of the cells, and scram rods are located in the center moderator of each cell. Gross radial power flattening is achieved by varying the amount of moderator in the center of the cell and by utilizing a thick beryllium side reflector. Performance characteristics were calculated for reactor exit air at 1200, 1300, and 1400°F. The 17 Mw(t) full power operating life potential of the fuel elements is 8400 hr. The specific power is 2.97 Mw/ft^3. (N.W.R.)

35142 (GNEC-210(Suppl.3)) DESIGN AND FABRICATION OF THE BONUS REACTOR PRESSURE VESSEL. SUPPLEMENT 3. J. F. Gibbons and A. S. Jameson, comps. (General Nuclear Engineering Corp., Dunedin, Fla.). July 31, 1963. Contract AT(40-1)-2674. 63p.

The technical progress of the BONUS reactor pressure vessel during the final stages of construction, inspection, shipment, and installation is described. Completion of manufacture, installation and receipt inspection, and hydrostatic tests are discussed. (M.C.G.)

35143 (IDO-16869) ORGANIC REACTOR TECHNOLOGY. Final Progress Report, October 1, 1962–January 31, 1963. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Apr. 26, 1963. Contract AT(10-1)-205. 73p.

Efforts of the EOCR Operations organization were directed toward plant systems testing and, subsequently, the decommissioning of the EOCR, preparations for preservation of all plant equipment, and completion of the plant operating manuals. Technical progress on organic coolant technology is summarized. The combined effects of iron and high-boiler content on film formation were under study in circulating loop tests in the large rig. In Santowax OMP neither iron nor high boiler alone caused any increased fouling, but the combination resulted in the maximum rate of film deposition. Increased high-boiler content resulted in a linear increase in the carbon content and decrease in the ash in the film. The behavior of iron in polyphenyl fluids was studied using a pyrolytic capsule apparatus. Film deposits were observed on the heat transfer surfaces when, and only when, a phase change occurs at this point. Investigation of solid salt columns for chromatography revealed valuable differences in behavior and peak shifting between different salts. Systems for complete analysis of the polyphenyls through hexaphenyl were developed using combinations of two columns. Correlations of all chromatographic data resulted in the development of a master chart which allowed prediction of the relative elution position for any isomer, and therefore the tentative identification of unknown peaks. Work on the synthesis of reference polyphenyls was brought to a close with synthesis of two of the 10 expected hexaphenyls from p-terphenyl dimerization and the completion of synthesis of several important intermediates. Several available petroleum feedstocks were refined by hydrodesulfurization and hydrodealkylation. Sulfur was reduced to less than 0.03 percent, but the most marked improvement in thermal and radiolytic stability was accomplished by hydrodealkylation. Several very stable and potentially valuable products were produced. (auth)

35144 (MND-M-2935(Vol.I)) PM-1 NUCLEAR POWER PLANT PROGRAM. VOLUME I. Final Progress Report, September 1, 1962 through Completion. (Martin-Marietta Corp. Aerospace Div., Baltimore). Contract AT(30-1)-2345. 27p.

The principal efforts during the final period were concerned with PM-1 plant testing, modifications to the plant to enable it to produce full design load at high ambient temperatures, the compilation and evaluation of plant performance data, preparation of documents and transfer of the plant to the AEC and final resolution of all outstanding contract scope items. (auth)

35145 (MND-MD-2560-9) PM RESEARCH AND DEVELOPMENT PROGRAM. Quarterly Progress Report No. 9, April 1 to June 30, 1963. (Martin-Marietta Corp. Aerospace Div., Baltimore). July 1963. Contract AT (30-1)-2706. 104p.

The parametric study of PM Core 3 was completed. A parametric investigation of finger control element worth indicates adequate control system worth with 150 or less finger elements. The power output capabilities of Core 3 were also evaluated parametrically. Two full-sized, simulated Core 2 lumped poison elements were fabricated and evaluated. UO_2 spheroidizing studies were performed; effective control of particle porosity by prespheroidizing oxidation or reduction treatments was demonstrated. The

Core 3 finger control element wear test program was initiated; the test fixture was designed and a literature survey to collect and evaluate wear data was performed. Nuclear and thermal-hydraulic analyses of the Core 3 irradiation experiment were completed. Analysis results for a low power irradiation of PM-1 fuel tubes correlated well with experimental measurements of power distribution and absolute power level, thus substantiating the calculational techniques. Fabrication process development for the Core 3 tubular irradiation specimens was completed. Irradiation specimens were fabricated and evaluated by destructive and nondestructive testing. The tubes satisfied all requirements with the exception of bonding between inner clad and core. Excessive interface contamination retarded the development of a metallurgical bond. A series of developmental tubes was fabricated in an attempt to eliminate the interface contamination. Process development for the coupon irradiation specimens continued. Approximately 10 to 20% of the required specimens were fabricated. Fabrication and evaluation of the Core 2-type tubular irradiation specimens were completed. Pre-experiment analysis in support of the finger control element tests was performed; reactivity control requirements for each experimental core were predicted. The experimental cell was reactivated. Design of simulated finger control elements for use in critical experiments was completed. A literature survey on experimental techniques for simulating two-phase (water-stream) flow was initiated. (auth)

35146 (MND-MD-2957) PM RESEARCH AND DEVELOPMENT TASK 1.0—CORE 2 FINAL DESIGN REPORT. F. Russo, W. Brittain, R. Lightner, and R. Baer (Martin-Marietta Corp. Aerospace Div., Baltimore). Apr. 1963. Contract AT(30-1)-2706. 183p.

The final design of Core 2, which is being developed primarily as a replacement core for the PM-1 and PM-3A nuclear power plants, is summarized. In addition, the thermal and hydraulic capabilities were investigated; these indicate applicability of the core to higher powered PM-type plants. Core 2, like the first generation cores, utilizes fully enriched uranium-stainless steel fuel elements of tubular configuration; and it is water moderated and cooled. External dimensions are identical to those of the PM-1 Core 1—a diameter of 23.1 inches and an active length of 30 inches. Core nuclear and thermal performance was considerably improved over that of the earlier cores. Lifetime was increased from 16.6 to 24.0-Mw-yr. The core may be shut down cold, with one rod fully withdrawn. Throughout life, the shutdown margin under this condition is 1.7% $\Delta k/k$, or greater, based on nominal fuel and poison loading. Accounting for fuel and poison loading tolerances, a minimum shutdown margin of 0.7% $\Delta k/k$ is assured. Thermal output of the core, with a flow rate of 2125 gpm and a mean temperature of 463°F, was increased from 10.4 to 13.3 Mw(t). Core mechanical design was somewhat simplified. (auth)

35147 (NAA-SR-7475) HYDRAULIC CHARACTERISTICS OF HNPF 8-ROD FUEL ELEMENT. R. J. Begley (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Aug. 15, 1963. Contract AT(11-1)-Gen-8. 24p.

Pressure drop and vibration characteristics were determined for an 8-rod fuel element model of the design intended for use with uranium carbide (UC) in the Hallam Nuclear Power Facility (HNPF). Measurements with water as the test fluid were converted to equivalent values for sodium, the HNPF coolant, using the principles of dimensional similitude. Initially UC elements will be concluded in an HNPF core loading comprised primarily of 19-rod U–Mo fuel elements. In this core loading, the UC fuel element requires 17.5 lb/sec of sodium coolant at a core pressure drop of 11 psi. The measured fuel element pressure drop ranged from 0.27 to 5.6 psi over the sodium flow range from 3.5 to 17.4 lb/sec. The existing HNPF variable orifice can adjust flow for this fuel element over the range from 5.7 to 21 lb/sec at a core pressure drop of 11 psi. No significant vibration of the fuel rods was induced by the flow of water. (auth)

35148 (NAA-SR-8224) OMRE FOURTH CORE HAZARDS REPORT. J. D. Gylfe, J. H. Campo, W. W. Davis, J. Marvosh, J. Otter, R. Stanbridge, and S. Yee (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Aug. 15, 1963. Contract AT-11-1-GEN-8. 92p.

The driver elements for the fourth core of the OMRE will consist of uranium-molybdenum alloy fuel plates clad in finned aluminum. In addition, the core will contain experimental uranium metal aluminum-clad plate-type elements and UO_2–APM pin-type elements. Since previous OMRE cores have been fueled primarily with highly enriched UO_2-stainless steel cermet-type fuel elements, this core represents a substantial change in design and composition. Therefore, complete steady-state performance analyses and transient accident analyses were performed for it and are reported herein. The analyses show that for any protected accident, the worst result is attainment of a maximum fuel surface temperature which is limited by nucleate boiling to a value between 900 and 1070°F, depending on the amount of nitrogen and/or water dissolved in the coolant. The minimum burnout ratio is greater than two in every case. (auth)

35149 (NP-13029) O.E.C.D. DRAGON HIGH TEMPERATURE REACTOR PROJECT FOURTH ANNUAL REPORT 1962–1963. (Organization for Economic Co-Operation and Development, Paris). 160p.

Progress on the Dragon Project is reported. Design work and civil construction were almost completed. Various core configurations were calculated in respect to reactivity, control, power, and temperature distributions. Measurements on the high-temperature circular and annular channels were continued. The work on rubbing components such as bearings and gears was continued. The final control rod mechanism is under test. Carbon transfer experiments showed that nickel has a very active catalytic effect on graphite corrosion and that vanadium, above a minimum content, gives rise to pitting corrosion. Tests indicated that graphite corrosion initiates dust formation. Considerable experience in assembly of fuel elements was gained in assembling the dummy charge. Development work on coated-particle fuel was continued. A graphite free from carbon black with the required pore size characteristics was developed. The primary heat exchanger pressure casings were welded into position in the reactor and the heat transfer tube bundles are nearing completion. Acceptance testing of the primary gas circulators was continued. The fuel handling machine has reached an advanced stage of assembly. (M.C.G.)

35150 (ORNL-2536) A ZERO POWER REFLECTOR-MODERATED REACTOR EXPERIMENT AT ELEVATED TEMPERATURE. D. Scott, G. W. Alwang, E. F. Demski, W. J. Fader, E. V. Sandin, and R. E. Malenfant (Oak Ridge National Lab., Tenn.). Aug. 14, 1958. Contract W-7405-eng-26. 94p.

An experiment using a full-scale mockup of the core and reflector of Pratt and Whitney Aircraft Reactor No. 1

(PWAR-1), a reflector-moderated reactor, was performed at zero power and elevated temperatures in the ORNL Critical Experiments Facility. The mockup consisted of a 8.1-in.-dia cylindrical beryllium central region surrounded by a fuel annulus contained between two Hastelloy-X core shells. The inner shell was 8.5 in. in diameter and 0.125 in. thick. The outer one varied from 21.4 in. in diameter and 0.156 in. in thickness at the midplane to 14.8 in. in diameter and 0.25 in. in thickness at the ends. This core shell assembly was covered by a 13-in.-thick beryllium reflector. Coolant passages, but not the coolant, were mocked up in both beryllium regions. The control and safety rod consisted of a 2.4-in.-OD × 2.00-in.-ID cermet annulus composed of 70% nickel and 30% rare earth oxides contained in a 0.035-in.-thick Inconel jacket which was guided along the reactor axis by a 2.875-in.-OD Inconel tube with 0.120-in.-thick walls. The fuel was a mixture of the fused fluoride salts of sodium, zirconium, and uranium. The critical concentration of the clean reactor was 10.22 wt % U^{235} at 1258°F. The calibration of the control rod over the range from the midplane to the top of the beryllium resulted in an increase in fuel concentration to 12.2 wt % U^{235} and an indicated value of $2.5. The specific mass reactivity coefficient $(\Delta m/m)/(\Delta k/k)$ was 5.90 ± 0.5 and was constant within experimental error over the range of the experiment. The temperature reactivity coefficient for this mockup, measured between 1200 and 1350°F, was −0.47¢/°F. The effect of a B^{10} neutron filter between the fuel annulus and the beryllium in the entrance duct region was evaluated for the fast leakage, fission rate distribution, and reactivity. The power distribution through the fuel region was measured by counting the fission fragment gamma activity in small uranium disks positioned in the fuel annulus throughout the experiment. A measure of the neutron flux distribution in the reflector was made with gold foils. In addition to the presentation of the measurements a discussion of the important engineering design features and construction problems is included. (auth)

35151 (ORO-606) EXPERIMENTAL GAS COOLED REACTOR. FINAL HAZARDS SUMMARY REPORT. VOLUME II. PLANT OPERATION. (Kaiser Engineers, Div. of Henry J. Kaiser Co., Oakland, Calif.; Allis-Chalmers Mfg. Co. Atomic Energy Div., Washington, D. C.; Oak Ridge National Lab., Tenn.; Tennessee Valley Authority, Oak Ridge, Tenn.; and Oak Ridge Operations Office, AEC). Aug. 1, 1963. 246p.

Information provided in Volume II describes programs, requirements, and procedures established by the operator to minimize the probability of equipment failure, actions taken during any emergency to minimize radiation exposure dose to the general public and to plant personnel, and actions taken following a hazardous condition to prevent its recurrence. The hazards report describes the safeguards program which deals with all phases of operation of the reactor, including those operations or tests prior to criticality and all subsequent operations including emergencies. (N.W.R.)

35152 (PRDC-TR-70) MONTHLY TECHNICAL REPORT [ON APDA ACTIVITIES], APRIL 1963. (Power Reactor Development Co., Detroit). Contract AT(11-1)-476. 16p.

Progress is reported on APDA activities including: fuel and metallurgy research, chemistry and materials research, steam generator physical chemistry studies, sodium-carbon program, engineering analysis, physics, systems development, mechanical design, electric systems and instrumentation, and test operations. (N.W.R.)

35153 (PRWRA-GNEC-5(Add.3)) ANSWERS TO QUESTIONS SUBMITTED BY THE DIVISION OF LICENSING AND REGULATION PER LETTER FROM R. LOWENSTEIN, DL&R, TO J. M. WEST, GNEC ON JULY 11, 1963. (General Nuclear Engineering Corp., Dunedin, Fla.). Aug. 9, 1963. Includes PRWRA-7, Attachment No. 1 to Addendum No. 3. BOILING NUCLEAR SUPERHEATER (BONUS) POWER STATION. BONUS EMERGENCY EVACUATION PROCEDURE. (Puerto Rico Water Resources Authority, San Juan). June 1963. PRWRA-GNEC-5 FINAL HAZARDS SUMMARY REPORT, ADDENDUM 3. Aug. 12, 1963. Contract AT(40-1)-2674. 145p.

This addendum consists of two parts: one part contains the answers to the questions submitted by the USAEC Division of Licensing and Regulation and the second part contains revisions of figures which appear in the hazards report and which should be substituted for the old figures. A summary of the revised figures to be replaced as well as a brief description of each revision is attached to each revised set of figures. (N.W.R.)

35154 (SRO-92) HEAVY WATER POWER REACTOR PROGRAM MONTHLY PROGRESS REPORT, JULY 1963. (Savannah River Operations Office, AEC). 9p.

Research and development progress is reported on the AEC-AECL cooperative program, the CANDU boiler section test, SAP testing, nondestructive tests, header and feeder piping fluid dynamics, zirconium technology, and metallurgy. Operation of the Heavy Water Components Test Reactor is summarized. Low-power physics and systems tests on the Carolinas–Virginia Tube Reactor are described. (M.C.G.)

35155 (TID-17885) N.S. SAVANNAH SAFETY ASSESSMENT. SUMMARY REPORT OF VOLUMES I THROUGH V. James M. Barrett and Paul E. Carrico (Maritime Administration, Washington, D. C. and Atomic Energy Commission, Washington, D. C.). Dec. 1962. 62p.

A safety hazards evaluation of the N.S. Savannah is summarized. The assessment covers engineering, construction, operations, radiological health, and analyses of hypothetical accidents. (N.W.R.)

35156 (WCAP-1972) A STUDY OF THE LOSS-OF-COOLANT ACCIDENT FOR THE SELNI REACTOR. R. Casini and F. Cioli (Societa Elettronucleare Italiana, Milan). May 1962. For Westinghouse Electric Corp., Atomic Power Div. Pittsburgh. 55p.

Some significant results of the study, such as temperature distributions in the fuel and the cladding at various times after the accident are given, together with basic assumptions and analytical procedures. A method is presented to calculate the amount of radioactive fission products diffused out of the UO_2 during normal reactor operation and after the accident. The impact of the calculations on the design philosophy of the safety injection system is also discussed. (auth)

35157 (AEC-tr-3874) PROJECT "ROCK'N ROLL." STABILITY EXPERIMENTS FOR BOILING LIGHT-WATER REACTOR FOR MARITIME PURPOSES. THE PROBLEM AND SUGGESTIONS FOR ITS SOLUTION. Translation of "Prosjekt "Rock'n Roll." Stabilitetseksperimenter for Kokende Lettvannsreaktorer til Maritime Formal. Problemstilling og Forslag til Losning," (Norway. Institutt for Atomenergi, Kjeller). Aug. 1959. 51p.

A research project (Rock'n Roll) for the purpose of finding a solution to problems connected with the stability of a boiling ship reactor is described. The design of the boiling water reactor is given. Problems of stability are dis-

cussed along with suggestions for solving the problems. The proposition is to construct a boiling light-water reactor in a ball which must make it possible to test the stability of the reactor and other properties under simulated maritime conditions, such as rolling of the ship, pitching, vibrations, permanent listing, and shock effects in collisions and in a situation where the ship runs aground. The ball which encloses the reactor, the control room, and all auxiliary machines is planned to serve as a combined safety container and float. (N.W.R.)

35158 STUDY OF THE SPENT FUEL ELEMENTS OF THE FIRST SOVIET ATOMIC POWER STATION. Sh. Sh. Ibragimov, L. A. Syshchikov, I. M. Voronin, and V. G. Kudryashov. At. Energ. (USSR), 14: 465-8(May 1963). (In Russian)

Study of fuel elements after use in the reactor represents an excellent tool for evaluating the reliability of the design and the suitability of the system for continuous long-range operation. For this reason, the fuel elements used in the First Soviet Atomic Power Station for periods of 111, 324, and 557 effective days, corresponding to U^{235} burnup levels of 11.8, 28, and 59%, were examined by inspecting them externally, measuring the diameter, cutting out a sample, carrying out metallographic tests, and determining the mechanical properties. The U^{235} enrichment of the U–Mo alloy of the elements was 5% in the first and third sets and 6% in the second set of elements. The surface temperature was kept at 360 to 370°C; the outside surface of the elements was in contact with a gas consisting primarily of N_2. The largest increase of the diameter was noted near the center, amounting to 0.10, 0.15, and 0.20 mm, respectively, for the 3 sets. The microstructure of the first 2 groups did not show any changes; the elements used for 557 days exhibited microcracks starting at the external surface of the jacket; this is probably due to the embrittlement of the U–Mo alloy. The microhardness and the tensile strength of the specimens were found to be increased while the δ was decreased. Increasing burnup appeared to enhance the hardening and the embrittlement. The effects were annealed out by soaking at 650°C for 30 minutes. (TTT)

35159 NUCLEAR ENERGY AND THE PRODUCTION OF ELECTRICAL ENERGY. D. Francisco Pascual Martínez. Energia Nucl. (Madrid), 7: No. 25, 22-30(Jan.-Mar. 1963). (In Spanish)

In the production of electrical energy from nuclear energy, three types of reactors are presently used: graphite-moderated, gas-cooled reactors with natural uranium; pressurized-water reactors; and boiling-water reactors. The present and future prospects for the development of these reactor types to economic competition with conventional sources of electrical energy are discussed. These generalizations are then considered with respect to their economic development in Spain. (J.S.R.)

35160 SAFETY RESEARCH IN SUPPORT OF A POWER-REACTOR PROGRAM. F. R. Farmer. Nucl. News, 6: No. 8, 7-12(Aug. 1963).

A review of safety research on power reactors in the United Kingdom is presented. The review is limited particularly to the graphite-moderated gas-cooled reactor. The type of safety information gained from design and operating experience is discussed. The experimental and theoretical work associated with structural stability and gas-flow patterns during depressurization, graphite oxidation, pressure vessel failures, fission-product release, and clean filtration research is presented. (C.E.S.)

35161 HALLAM NUCLEAR POWER FACILITY—SPECIFICATIONS (Engineering Materials). (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). (CAPE-1007)

This package contains 19 specifications. The specifications for the Hallam Nuclear Power Reactor include those for the sodium systems, helium systems, steam system, reactor, instrumentation and control system, and alarms and communication. The chief advantage of this reactor design is considered to be that high temperature conditions without corresponding high pressures are available in the primary Na coolant. Copies of these specifications are available from the Division of Technical Information Extension. (F.E.S.)

35162 PIQUA POWER FACILITY (OMR)—SPECIFICATIONS (Engineering Materials). (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). (CAPE-1009)

This package contains 27 specifications. These 27 specifications are for the organic-moderated Piqua Power Reactor. The reactor is cooled and moderated by terphenyl. This organic coolant, which allows the system to operate at a low pressure, eliminates hazardous chemical reactions, corrosion to ordinary construction materials, and induced radioactivity in the primary coolant. The reactor has a negative temperature coefficient of radioactivity which limits power surges and excess power levels. The reactor core is composed of 85 fuel elements, 13 control rods, and 2 neutron sources. The steel reactor vessel is 7 ft 8 in. ID, 27 ft $3\frac{1}{2}$ in. inside height, and is located below ground level. Copies of these specifications are available from the Division of Technical Information Extension. (F.E.S.)

35163 OPERATING EXPERIENCE AT HALLAM NUCLEAR POWER FACILITY. J. Denny Cochran (Consumers Public Power District, Hallam, Neb.). 15p. (CONF-15-5)

From American Power Conference Meeting, Chicago, Mar. 1963.

Testing of the Hallam Nuclear Power Facility up to 38 Mwt, or 15% of full power, shows this sodium-cooled, graphite-moderated, thermal reactor to be a reliable heat source, easily controlled. This report is limited to operating experience acquired in testing up to 15% of full power. This facility is currently scheduled for commercial power production in 1963. Production of superheated steam and the low pressure in the reactor core, which are inherent with this sodium-cooled reactor, provide attractive economic and safety features for this system. (auth)

35164 POST-CONSTRUCTION TESTING OF THE ELK RIVER, HALLAM, AND PIQUA POWER REACTOR PLANTS. C. A. Pursel (Atomic Energy Commission, Argonne, Ill.). Vienna, International Atomic Energy Agency, 1963, Preprint CN-15/5, 68p. (CONF-69-10). (In English)

From Conference on Operating Experience With Power Reactors, Vienna, June 1963.

Actual experience gained during the post-construction testing of three nuclear power plants permit generalizations concerning this phase of plant construction and operation. The three plants, Elk River Reactor, Hallam Nuclear Power Facility, and the Piqua Nuclear Power Facility represent three different reactor concepts: natural circulation boiling water, sodium–graphite, and organic cooled and moderated, respectively. The post-construction testing period included the time between the end of construction and the beginning of power operation. The tests were intended to: verify the performance characteristics of the as-installed equipment, obtain initial criticality and reac-

tivity coefficient measurements, and determine reactor physics and plant performance characteristics at a sequence of increasing power levels. The experience gained is reported in six separate but interrelated categories: schedule, costs, staffing requirements, procedures, equipment performance, and actual, as compared to predicted, system performance characteristics. (auth)

35165 PERFORMANCE CHARACTERISTICS OF EBWR FROM 0-100 MW. PART A. GENERAL OPERATION AND STABILITY PERFORMANCE. PART B. THERMAL, HYDRAULIC AND PHYSICS DATA. E. A. Wimunc, M. Petrick, W. C. Lipinski, and H. Iskenderian (Argonne National Lab., Ill.). Vienna, International Atomic Energy Agency, 1963. Preprint No. CN-15/3, 90p. (CONF-69-11)

From IAEA Conference on Operating Experience with Power Reactors, Vienna, June 1963.

Data and information on the performance characteristics of the EBWR 100 Mw reactor are presented. Many new instrumentation techniques were developed for obtaining the desired data. The goal was successfully achieved, and many new data were obtained on the performance characteristics of a natural circulation boiling water reactor. The data derived from this program provided information on recirculation flow rates, vapor liquid separation limits, subcooling, location of the true interface in the reactor and its relation to the water column level, steam collapse rates in the downcomer, void coefficients, H_3BO_3 worth, temperature coefficients, use of boron strips for control purposes, use of spike elements, transfer functions, noise analysis, some flux measurements, stability, etc. In addition, data were obtained on the behavior and integrity of certain reactor components and systems such as boric acid control, radiation levels, corrosion product distribution, equipment malfunctions, fuel and control rods, etc. EBWR's performance characteristics were governed almost exclusively by steam carry-under in the downcomer, liquid carry-over in the effluent steam, and indirectly by the location of the true interface in the vessel. Carry-under was the dominating factor in the lower power range. Above 65 Mw the reactor's performance characteristics changed radically. The steam disengaging velocity reached 1 ft/sec and the steam dome height decreased to 3 ft. Under these conditions liquid carry-over occurred and increased rapidly with increasing power. The reactor no longer behaved as a direct cycle boiling water reactor; in a sense it functioned as a natural circulation dual cycle reactor. (auth)

35166 POWER CYCLING OF FUEL SPECIMENS CLAD WITH THIN-WALL STAINLESS STEEL. T. C. Bowland and J. S. Atkinson (General Electric Co., San Jose, Calif.). 12p. (CONF-39-84)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Three 0.010-inch-wall, 0.400-inch-diameter, 8-inch-long, stainless-steel-clad fuel specimens were power cycled 3000 times each between 500,000 and 75,000 Btu/hr-ft^2 in the GETR Trail Cable facility without clad failure or any significant changes in the clad dimensional characteristics. Two compacted powder fuel specimens, and one swaged over pellet fuel specimen with clad surface scratches were tested. Test conditions and results were listed. The number of power cycles and the power variation during each cycle were probably greater in the experiment than would be experienced in the Consumers Big Rock nuclear power plant. However, the cladding strain effects are not necessarily equivalent to long-term cycling operation. The main effects of long term irradiation not reached in this experiment were: buildup of internal pressure from fission gas release; long term corrosion effects; and changes in the physical properties of the clad by the mechanisms of irradiation hardening, creep, and stress relaxation. (auth)

35167 THE NUCLEAR MATERIALS AND FUEL MANAGEMENT PROGRAM FOR THE DRESDEN NUCLEAR POWER STATION. G. R. Parkos and A. F. Veras. 9p. (CONF-80-5)

From Institute of Nuclear Materials Management 4th Annual Meeting, Buffalo, June 1963.

The program for nuclear material accountability and fuel management for the Dresden Nuclear Power Station is described in detail. Power distribution, fuel accounting procedures, and isotopic composition and exposure are discussed. (P.C.H.)

35168 MARINE REACTOR WITH A NUCLEAR REACTOR AND AN AUXILIARY HEAT EXCHANGER SYSTEM. John Alan Dodd (to United Kingdom Atomic Energy Authority). German Patent 1,150,764. June 27, 1963. Priority date Dec. 15, 1958, Great Britain.

An apparatus for removing fission product heat from the fuel elements in the core of a nuclear reactor aboard a ship is described. This apparatus comprises a plurality of secondary heat exchangers and associated header tanks disposed around the reactor core structure each of the secondary heat exchangers being offset radially from the vertical axis and each header tank being offset radially from its associated secondary heat exchanger with respect to the vertical axis of the reactor core structure. Each of the secondary heat exchangers and its associated header tank are located in a vertical plane that comprises the vertical axis of the core. (Gmelin Inst.)

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Refer also to abstract 34717.

35169 (CONF-39-51) FUEL ELEMENTS FOR THE ARGONNE ADVANCED RESEARCH REACTOR. N. R. Adolph, M. S. Silberstein, and A. Weinstein (United Nuclear Corp. Development Div., White Plains, N. Y.). [1962]. Contract W-31-109-38-1491. 18p.

From American Nuclear Society Meeting, Salt Lake City, June 1963.

The core design and the fuel element concept for the high-flux Argonne Advanced Research Reactor are presented. The core is cooled and moderated by light water and utilizes beryllium as a reflector. The fuel element assembly is rhomboidal in cross section and consists of 27 plates fastened together at their edges by dovetailed locking keys, and at each end by end fittings. Each fuel plate is 40 mils thick and contains a uniform dispersion of highly enriched UO_2 particles, up to a maximum of 37 wt %, in a matrix of sintered stainless steel powder. A 5 mil thick stainless steel cladding is metallurgically bonded to each side of the fueled matrix. (N.W.R.)

35170 (CRE-1155) COMPRESSION TEST RIG FOR FUEL BUNDLES. G. E. Shaw (Atomic Energy of Canada Ltd., Chalk River, Ont.). June 1963. 15p. (AECL-1783)

A test rig was designed and built to carry out axial compression tests on NPD and CANDU fuel bundles, both before and after irradiation and at room temperature and elevated temperatures. The bundle under test is loaded by means of a hydraulic ram. The recording equipment plots a continuous load versus deflection curve. (auth)

35171 (PAEC(D)PH633) NONDESTRUCTIVE STUDIES ON THE STRUCTURE OF PRR-I FUEL PLATES. Jose O. Juliano and Pericles T. Meneses (Philippines. Atomic Energy Commission. Atomic Research Center, Manila). Mar. 1963. 11p.

The parameters and specifications of the Philippine Research Reactor-I fuel plates are given. The fuel plates consist of aluminum-clad aluminum–uranium alloy matrix. The PRR-I plates are 60 mils thick; the matrix portion being 15 mils. (N.W.R.)

35172 (RISÖ-56) AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE DYNAMIC CHARACTERISTICS OF THE NUCLEAR REACTOR DR 3. P. la Cour Christensen (Denmark. Atomenergikommissionen. Forsogsinstitut, Risø). Feb. 1963. 48p.

The dynamic characteristics of DR-3, a Dido-type reactor, were investigated experimentally in the normal power range 5 to 10 Mw. A theoretical model is developed for the same power range. The experimental and theoretical results are in good agreement. (auth)

35173 (TID-19056) REACTIVITY DETERMINATIONS IN THE K.S.U. GRAPHITE SUB-CRITICAL ASSEMBLY (thesis). Norman Dean Eckhoff (Kansas State Univ., Manhattan. Engineering Experiment Station). 1963. Contract [AT(11-1)-308]. 115p.

Kansas State Univ. Eng. Expt. St. Spec. Rept. No. 35.

A study is presented of the various mathematical models that were used to calculate the control rod worth of a cadmium rod in the Kansas State University graphite subcritical reactor. A kinetic study was attempted. Several hundred rod drops were performed. The models used included one-group diffusion, two-group diffusion, and perturbation models. The data were considered too random for any clear-cut conclusions. (M.C.G.)

35174 (WCAP-3701) DESIGN AND HAZARDS REPORT. LRD IRRADIATION TEST NUMBER 1. A. S. Kitzes (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). July 15, 1963. Contract AT(30-1)-3064. 78p.

A description is given of the test objectives, test loop, test piece design, test procedure, and an analysis of the hazards associated with the performance of the experiment in a test reactor. The purpose of the experiment is to determine the acceptability of chemical shim operation in large plants by simulating the plant conditions of metal temperatures, coolant temperatures, pressure, flow, and water chemistry. (auth)

35175 DETERMINATION OF IRRADIATION COSTS IN A RESEARCH REACTOR. V. A. Tsykanov. At. Energ. (USSR), 14: 469-73(May 1963). (In Russian)

From the economic viewpoint a research reactor may be considered as a neutron-generating plant and the cost of producing the neutrons can be calculated. A certain fraction of the total neutrons produced is needed for the continued operation of the reactor; another portion is lost because of leakage and absorption; the cost must therefore be based on the portion of the total neutrons produced which is actually used in the experiments. In view of the great differences in the capital expenses and the operating costs of the various types of reactors, the cost figures are only valid for a given, actually operating reactor. These cost estimates are useful for deciding whether a given experiment should be removed from an expensive reactor and installed in a cheaper one. The overall expenses are based on funds needed for amortizing the investment, operational costs, and fueling costs. The needed amortization can be easily calculated from the capital investment which is known at the time of construction; however, the actual life of a research reactor is not easy to predict. The operational costs are calculated from the personnel payroll and materials expenditures for steam, electricity, water, and maintenance. A formula was derived for calculating the fuel costs. In assigning the cost, the expenses must be distributed among the various experiments involved, taking into account the reactivity effects of the irradiated samples. A general formula is presented for estimating the cost of individual reactor and neutron beam experiments. (TTT)

35176 THE SLOW NEUTRON SPECTRUM IN THE HORIZONTAL BEAMHOLE OF THE VVR-S REACTOR. R. B. Begzhanov, D. A. Gladyshev, S. V. Starodubtsev, and T. Khaidarov. At. Energ. (USSR), 14: 490-1(May 1963). (In Russian)

A mechanical chopper, similar to that described by V. I. Mostovoĭ et al. (Transactions of the Second Geneva Conference for the Peaceful Uses of Atomic Energy, 1958), was used for determining the neutron energy distribution in the VVR-S reactor of the Uzbek Academy of Sciences. The 150-mm diameter rotor of the chopper had 13, 1-mm wide slits; the flight path to the B counter, serving as the detector, was 7.6 m long. A multichannel analyzer was used for examining the time-of-flight; the width of the channels could be adjusted from 1 to 128 microseconds; their dead time was 10 microseconds. It was found that the slow neutron spectrum follows a Maxwellian distribution only in the wavelength range from 0.75 to 1.5 Å, with a maximum at $\lambda_0 = 1.24$ Å. Dips in the distribution curve corresponded to known resonance absorption levels of U^{238} (0.062 and 0.11 Å; similar reductions in the neutron flux were also noted in the range of the U^{235} resonances at 0.268 and 0.53 Å). The neutron temperature was 375°K at a moderator temperature of 308°K. The measurements were carried out while the reactor was operated at 2000 kw level. (TTT)

35177 THE START-UP OPERATION OF GAS-COOLED LOOP WITH URANIUM FUEL ELEMENT. František Berger, Antonín Cihlář, and Emil Pelčík (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Prague). Jaderna Energie, 9: 213-19(1963). (In Czech.)

A brief description of the state of the gas-cooled loop in the WWR-S reactor is given. The main attention is given to the experience of first active operation in which all loop elements were proved. Important measured values were compared with design values. The experience with mechanical parts, instrumentation, and dosimetric apparatuses is described. (auth)

35178 PROGRAMMING AND UTILIZATION OF RESEARCH REACTORS. PROCEEDINGS OF A SYMPOSIUM HELD IN VIENNA, OCTOBER 16-21, 1961. VOLUME 3. London, Academic Press, 1962. 515p. $15.00.

Separate abstracts were prepared for 35 of the 37 papers on research reactor designs, development, uses, programs, facilities, and research. Two papers were previously abstracted in NSA. (D.C.W.)

35179 UTILIZATION OF MEDIUM-POWER RESEARCH REACTORS FOR REACTOR ENGINEERING STUDIES AT THE OAK RIDGE NATIONAL LABORATORY. F. C. Maienschein (Oak Ridge National Lab., Tenn.). p.3-25 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Experiments performed with low- or medium-power reactors for reactor shielding studies, energy spectral determinations for heat generation and radiation damage studies, investigations of research reactor safety, and the

training of nuclear engineers are described. Data are shown, and needs for further research are pointed out. (D.C.W.)

35180 FLEXIBLE LOW-POWER REACTORS FOR REACTOR ENGINEERING RESEARCH. W. C. Redman (Argonne National Lab., Ill.). p.27-50 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The features, operation, and use of the Zero-Power Reactors used in the Argonne reactor development program are reviewed. Recommendations on the nature, staffing, and research program of future low-power facilities are included. (D.C.W.)

35181 UTILIZATION OF A 10-kw REACTOR FOR TRAINING AND RESEARCH IN NUCLEAR ENGINEERING. Glenn Murphy and Virginia P. Denisen (Iowa State Univ., Ames). p.51-6 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Research programs that may be or have been undertaken with a 10-kw reactor are listed, and the advantages of using a small reactor are pointed out. Very few research activities are impractical with a low-power reactor. (D.C.W.)

35182 THE USE OF SMALL REACTORS FOR REACTOR PHYSICS. Herbert Kouts (Brookhaven National Lab., Upton, N. Y.). p.57-62 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (BNL-5651). (In English)

Experiments in reactor physics that can be done with small reactors are suggested. Costs, requirements, and methods for a reactor physics program are discussed. (D.C.W.)

35183 MEASUREMENT OF NEUTRON FLUXES AND NEUTRON SPECTRA. K. G. Stephens, R. Van Der Walt, and G. H. Williams (Associated Electrical Industries, Aldermaston Court, Berks, Eng.). p.63-78 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Neutron flux measurements made in the MERLIN 5-Mw research reactor with activation detectors (Au, Mn, P, Al, and Mg) during commissioning, and subsequent fast neutron spectra measurements made with threshold detectors (P, S, Mg, Al, and Fe), are described. Properties of the detectors are given, and the methods and materials used are discussed. (D.C.W.)

35184 VARIOUS ASPECTS OF THE STUDY OF REACTOR EXPERIENCES: EXPERIMENTATION. P. Delattre, J. P. Genthon, and J. Lalere (Commissariat à l'Energie Atomique, Paris). p.99-124 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In French)

The technique developed to direct experiments to research reactors most suited for them and to facilitate their successful completion is explained. Associated facilities (hot cells, etc.) needed at research reactors and problems met in certain types of experiments are also discussed. (D.C.W.)

35185 NUCLEAR PHYSICS RESEARCH WITH REACTORS. H. Maier-Leibnitz (Technische Hochschule, Munich). p.131-53 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Areas of nuclear physics that can be explored using fairly powerful reactors are pointed out. 85 references. (D.C.W.)

35186 EXPERIMENTAL HEAVY-WATER REACTOR OF THE INSTITUTE OF THEORETICAL AND EXPERIMENTAL PHYSICS, ACADEMY OF SCIENCES, USSR. P. A. Krupchinskii (Ministry for Peaceful Uses of Atomic Energy, USSR). p.155-71 of "Programming and Utilization of Research Reactors. Vol. 3" London, Academic Press, 1962. (In Russian)

Research being carried out in nuclear and reactor physics with the heavy-water reactor is described. Organization and planning of the experiments are discussed, and some particular experimental arrangements are examined. (D.C.W.)

35187 EXPERIENCE GAINED IN RESEARCH IN THE FIELD OF NUCLEAR AND SOLID STATE PHYSICS AT THE KJELLER RESEARCH ESTABLISHMENT. T. Riste (Institutt for Atomenergi, Kjeller Research Establishment, Norway). p.173-6 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The instigation, development, and nature of the Kjeller research program are reviewed; the facilities, personnel, and scope required for a successful program are discussed. (D.C.W.)

35188 UTILIZATION OF LOW POWER REACTORS IN THE PHYSICS OF SOLIDS. André Herpin (Centre d'Etudes Nucleaires, Saclay, France). p.177-84 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In French)

Neutron diffraction, inelastic scattering, and solid irradiation experiments are discussed to determine which experiments can be performed successfully with low-power reactors. The inelastic scattering studies are noted to be beyond the range of the low-flux reactors that have definite advantages for various other experiments on the properties of solids. (D.C.W.)

35189 RESEARCH PROGRAMS IN PROPERTIES OF MATERIALS. A. W. McReynolds and W. L. Whittemore (General Atomic Div., General Dynamics Corp., San Diego, Calif.). p.185-204 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Properties that have been examined by nuclear reactor radiations, the procedures and apparatus used, and the nature of the measurements made and the information gained are reviewed. (D.C.W.)

35190 REVIEW OF RESEARCH WORK IN PHYSICS IN HUNGARY CARRIED OUT WITH HELP OF THE VVRS-TYPE REACTOR. p.205-22 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Research dealing with the time distribution of the U^{235} fission fragment gamma radiation, (n,γ) reactions, neutron diffraction, cold neutron scattering and transmission, and nuclear radiation effects on order-disorder transformation in alloys is outlined. (D.C.W.)

35191 RADIATION DAMAGE RESEARCH IN LOW-POWER NUCLEAR REACTORS. D. S. Billington and D. O. Thompson (Oak Ridge National Lab., Tenn.). p.223-38 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Basic concepts in radiation damage experiments are summarized, and the advantages of low-power reactors for solid state and radiation damage research are discussed. Facilities and measurement techniques used in some in-pile experiments at the Oak Ridge Graphite Reactor are described. (D.C.W.)

35192 EXPERIMENTAL FACILITIES FOR THE INVESTIGATION OF RADIATION DAMAGE IN ORGANIC LIQUIDS AT THE REACTOR STATION GEESTHACHT. Erich Fischer (Kernenergieverwertung in Schiffbau und Reactorstation Geesthacht of Gesellschaft für Schiffahrt gmbH., Hamburg). p.239-43 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The irradiation facilities at the Geesthacht station are briefly described, and the analytical equipment and methods used are listed. (D.C.W.)

35193 A PROGRAM OF RESEARCH IN RADIOCHEMISTRY AND RADIATION CHEMISTRY BASED ON A SMALL NUCLEAR REACTOR. F. S. Rowland (Univ. of Kansas, Lawrence). p.253-62 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Experiments that can be performed with a 10-kw reactor with an available neutron flux of 10^{11}n/cm^2/sec are described. The synthesis of labeling isotopes by direct radiation is considered as well as experiments in radiochemistry and radiation chemistry. (D.C.W.)

35194 RADIATION CHEMICAL STUDIES IN RESEARCH REACTORS. M. Tomlinson and J. Wright (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.263-75 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The problems of precise dosimetry, induced radioactivity, and complex irradiation equipment that could hinder the use of research reactors for chemical studies are discussed. Appropriate choice of technique or reactor facility is found to reduce or eliminate the difficulties. Research reactors are also noted to be quite useful for studying the chemical effects of heavy particle damage. (D.C.W.)

35195 THE RADIATION FIELD OF THE BER AND ITS APPLICATION. Konrad Wasserroth (Hahn-Meitner Institute for Nuclear Research, Berlin). p.277-84 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Properties of the BER (a homogeneous solution reactor) and its radiation field are given; its features, limitations, and special experimental facilities are pointed out. Some results of research being performed with the reactor are included. (D.C.W.)

35196 NEUTRON-ACTIVATION RESEARCH. Roman A. Schmitt (General Atomic Div., General Dynamics Corp., San Diego, Calif.). p.285-305 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The methods, experiences, and some representative results of neutron-activation programs in the geochemical and biological disciplines are presented. Results of some practical applications of activation analyses to a variety of fields, such as petroleum, entomological, and citrus studies are also included. (auth)

35197 NEW METHODS OF RADIO-ACTIVATION ANALYSIS BASED ON DELAYED NEUTRON EMISSION AND SECONDARY REACTIONS. Saadia Amiel (Israel Atomic Energy Commission Labs., Rehovoth). p.307-14 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Activation techniques developed for the determination of U^{235}, U^{238}, Th^{232}, O^{18}, Li^6, and D_2 are described, and results are shown. Delayed neutron emission and neutron-induced secondary reactions are used. (D.C.W.)

35198 ACTIVATION ANALYSIS WITH A LOW POWER RESEARCH REACTOR. D. E. Green (Associated Electrical Industries Ltd., Aldermaston Court, Berks, Eng.). p.315-20 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

Properties and facilities of the MERLIN research reactor are given, and a method devised for determining many elements in semiconductor materials in one single separation scheme is described. Use of short irradiation times and fast neutron reactions is discussed along with fast neutron reaction interference in thermal activation analysis. (D.C.W.)

35199 FISSION PRODUCT DETECTION AND WATER ACTIVITY MEASUREMENTS IN A WATER COOLED RESEARCH REACTOR. S. E. Rippon (Associated Electrical Industries Ltd., Aldermaston Court, Berks, Eng.). p.333-46 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The fission product detector used in MERLIN is described, and a theoretical analysis of product (fission and non-fission) build-up is presented. Measurements of fission product and other activity levels in the reactor water are discussed. (D.C.W)

35200 RADIOACTIVITY PROBLEMS ASSOCIATED WITH INSTALLATION, OPERATION, AND MAINTENANCE OF RESEARCH REACTORS. Nejat M. Aybers (Technical Univ., Istanbul). p.347-52 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The source, effects, control, and removal of radioactivity in swimming-pool reactor water are discussed. The influence of radioactivity on system design, installation procedure, and operation and maintenance policy is noted. (D.C.W.)

35201 SOME CONSIDERATIONS OF ISOTOPE PRODUCTION IN A RESEARCH REACTOR. G. B. Cook (International Atomic Energy Agency, Vienna). p.363-8 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The annual usage of radioisotopes by a nonproducing country is estimated, and considerations involved in domestically producing the required isotopes are discussed. Steps in the development of an isotope production program are outlined; costs and facilities for each step are estimated. (D.C.W.)

35202 UTILIZATION OF THE VVRS TYPE REACTOR IN HUNGARY FOR ISOTOPE PRODUCTION AND RESEARCH IN NUCLEAR CHEMISTRY. I. Kiss (Central Research Inst. for Physics, Budapest). p.369-77 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The operation and functioning of the isotope production program is outlined, and radiochemical research to develop new production methods is summarized. Uses of activation analysis and radiation chemistry research facilities are described. (D.C.W.)

35203 PRODUCTION OF RADIOELEMENTS IN A EL3 TYPE REACTOR. R. Henry and P. Germond (Centre d'Etudes Nucleaires, Saclay, France). p.379-86 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In French)

The channels, pneumatic tube system, and other irradiation facilities for radioelement production at the EL3 reactor are described. Their uses, limitations, and advantages are indicated. (D.C.W.)

35204 EXPERIENCE IN RADIOISOTOPE PRODUCTION IN NORWAY. U. Been (Institutt for Atomenergi, Kjeller, Norway). p.387-93 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The irradiation, laboratory, and isotope handling facilities at Kjeller are described, and the production and distribution of isotopes are outlined. (D.C.W.)

35205 A RADIOISOTOPE PRODUCTION FACILITY UTILIZING THE INCHAS 2 MW RESEARCH REACTOR. H. Mahmoud, M. A. El-Guebeily, and E. Hallaba (Atomic Energy Establishment, Cairo). p.395-403 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The isotope production laboratory and its ventilation, waste disposal, radiation monitoring, and internal communication systems are described. (D.C.W.)

35206 PRODUCTION OF RADIOISOTOPES IN EXPERIMENTAL IRT AND VVR-S REACTORS. E. E. Kulish (Ministry for Peaceful Uses of Atomic Energy, USSR). p.405-16 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In Russian)

A brief account of the special radiochemical laboratories for processing irradiated materials and producing labeled compounds that are widely used in clinical, medical, and biological research is given. Some of the standards to which irradiated raw materials and irradiation conditions must conform are also discussed. (auth)

35207 AN ISOTOPE PRODUCTION PROGRAMME IN INDIA. V. K. IYa (Atomic Energy Establishment, Trombay, India). p.417-24 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The facilities and methods used to irradiate samples in the APSARA reactor and to chemically process the samples are described. Isotope output, quality control, and future operations are briefly discussed. (D.C.W.)

35208 THE REACTOR AS A TOOL FOR RESEARCH IN PLANT SCIENCES AND AGRICULTURE. Harold H. Smith (Brookhaven National Lab., Upton, N. Y.). p.425-38 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (BNL-5650). (In English)

Neutron irradiation facilities are discussed, and studies comparing the immediate, genetic, and cytological effects of neutrons on plants with those of x and γ rays are cited. Neutron bombardment is observed to have certain advantages for such studies. Radioisotopes suitable for tracers in plant research are considered. (D.C.W.)

35209 THE NUCLEAR REACTOR AS A TOOL IN AGRICULTURAL RESEARCH. W. F. Oosterheert, D. de Zeeuw, and C. Broertjes (Inst. for Atomic Sciences in Agriculture, Wageningen, Netherlands). p.439-42 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The facilities and reactor at the agricultural institute at Wageningen, Netherlands, are described; and the objectives and subjects of the research program are given. (D.C.W.)

35210 A REMARK ON THE BIOLOGICAL APPLICATIONS OF RESEARCH REACTORS. Y. Arnaud, P. Pereau-Leroy, and D. Comar (Commissariat à l'Energie Atomique, Saclay, France). p.443-9 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In French)

Reactor installations for biological research in France are described and uses of the reactors in agriculture, biological, and medical research, and radiobiological studies are discussed. (D.C.W.)

35211 USES OF NUCLEAR REACTORS IN MEDICAL AND BIOLOGICAL RESEARCH. J. S. Robertson, E. E. Stickley, and L. E. Farr (Brookhaven National Lab., Upton, N. Y.). p.451-61 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (BNL-5649) (In English)

Areas for future study involving the biological effects of neutrons and neutron activation analysis are indicated. Some information on methods, previous work, and research requirements is included. 71 references. (D.C.W.)

35212 PLANS FOR A RESEARCH REACTOR IN PAKISTAN. M. N. Alam and S. A. Hasnain (Pakistan Atomic Energy Commission, Karachi). p.471-4 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In English)

The reactor and its irradiation facilities are briefly described; and experiments to be performed after its criticality, as well as its projected uses for research, training, and isotope production, are outlined. (D.C.W.)

35213 ON THE DEVELOPMENTS IN INTERNATIONAL AND USSR COOPERATION IN THE FIELD OF EXPERIMENTAL REACTORS. p.475-84 of "Programming and Utilization of Research Reactors. Vol. 3." London, Academic Press, 1962. (In Russian)

Aid given by the Soviet Union to various countries in constructing research reactors, personnel training, and research project planning is discussed. Establishment and operation of research centers are also considered. (D.C.W.)

35214 THE WHITE SANDS MISSILE RANGE PULSED REACTOR FACILITY, MAY 1963. Robert L. Long, Russell A. Boor, William M. Cole, and Glenn E. Elder (Army Missile Test and Evaluation Directorate, White Sands Missile Range, N. Mex.). 20p. (CONF-39-54)

From American Nuclear Society Meeting, Salt Lake City, June 1963.

A brief statement of the mission of the White Sands Missile Range Nuclear Effects Laboratory is given. The new Nuclear Effects Laboratory Facility is described. This facility consists of two buildings – a laboratory and a reactor building. The White Sands Missile Range bare critical assembly, designated as the MoLLY-G, is described. The MoLLY-G, an unreflected, unmoderated right circular cylinder of uranium-molybdenum alloy designed for pulsed operation, will have a maximum burst capability of approximately 2×10^{17} fissions with a burst width of 50 microseconds. The reactor construction and operating procedures are described. As designed, the MoLLY-G will provide an intense source of pulsed neutron and gamma radiation for a great variety of experimental and test arrangements. (auth)

35215 NEUTRON PROPAGATION FROM A PULSED REACTOR. G. H. Miley and G. P. Beck (Univ. of Illinois, Urbana). 5p. (CONF-39-72)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

Neutron pulse propagation in thermal columns of a pulsed Triga-type reactor are investigated experimentally. The results are compared with the predictions of a Green's method calculation using a time-dependent diffusion kernel. (T.F.H.)

SPACE APPLICATIONS AND TECHNOLOGY

Refer also to abstract 35029.

35216 (ANL-6694) A 200-WATT CONDUCTION-COOLED REACTOR POWER SUPPLY FOR SPACE APPLICATION. Donald R. MacFarlane (Argonne National Lab., Ill.). Mar. 1963. Contract W-31-109-eng-38. 44p.

The limited supply of relatively long-half-life isotopes having a reasonably high power density and the low conversion efficiencies obtainable with thermoelectric devices have so far limited the power output of isotope-fueled sources of electric power to several tens of watts. In addition, the high cost of the available isotopes results in a very large expense for isotope-fueled generators producing several hundred watts. It appears that a small, minimum-weight, conduction-cooled reactor is an attractive alternate to the isotope-fueled power supplies in the 200-w size range. The proposed reactor is a small, high-density fast core of U^{233} surrounded by a beryllium reflector. This approach, generally speaking, gives a reactor that is more compact and of lighter weight than can be obtained with a moderated system having a softer neutron spectrum. In the reactor design, the path of heat flow is from the core to the inner reflector and then to the thermoelements in close contact with the inner reflector. The reject heat flowing from the thermoelement cold junctions enters the outer portion of the reflector, which acts as the heat sink and conducts the reject heat to the large, circular, tapered-fin radiator which is attached to the reflector. Survey physics calculations for various reactor systems fueled with U^{235}, U^{233}, and Pu^{239} are reported. Some limits imposed on the system design by the thermoelectric generator are discussed, and the problem of radiator design for the space environment is treated in some detail. No attempt is made to present a detailed final design of the power supply; rather, the report is restricted to a general delineation of the limits imposed by various parameters and a resulting final conclusion as to the performance limits of small conduction-cooled reactors in this size range. (auth)

35217 (CONF-17-7) POWER APPLICATIONS OF RADIONUCLIDES. Justin L. Bloom (Martin-Marietta Corp. Aerospace Div., Baltimore). [1963]. Contract [AT(30-1)-2345]. 26p.

From Oak Ridge Radioisotope Conference on Applications to Physical Science and Engineering, Gatlinburg, Tenn., April 1963.

The development and uses of SNAP power supplies which derive their energy from the decay of radioactive isotopes are discussed. (N.W.R.)

35218 (CONF-39-52) SNAP-50/SPUR REACTOR DEVELOPMENT. Frank D. Haines (Pratt and Whitney Aircraft Div., United Aircraft Corp. Connecticut Aircraft Nuclear Engine Lab., Middletown). [nd]. Contract [AT(11-1)-229]. 5p.

From American Nuclear Society Meeting, Salt Lake City, June 1963.

The development of the refractory metal-liquid metal-cooled SNAP-50/SPUR project including, as a first reactor, the Lithium-Cooled Reactor Experiment (LCRE) is discussed. Development of SNAP-50/SPUR is intended to provide for the generation of 300 to 1000 kw(e). The overall development program will consist of a proof-of-principle, non-flight component, reactor experiment to be followed by a series of simulated flight reactor tests which will culminate in flight testing of a completed powerplant. (N.W.R.)

35219 (LADC-5261) LOS ALAMOS NUCLEAR ROCKET PROJECT ROVER. Donald P. MacMillan (Los Alamos Scientific Lab., N. Mex.). [1962]. Contract [W-7405-eng-36]. 31p. (CONF-107-1)

From American Nuclear Society Materials Symposium, San Diego, Calif., Apr. 1962.

Developments in Project Rover are reviewed. History, considerations in reactor design, materials problems, and reactor construction and test are discussed. (M.C.G.)

35220 (LAMS-2932) RADIATION MEASUREMENTS OF THE EFFLUENT FROM THE KIWI B-1A, B-1B, AND B-4A REACTORS. H. M. Ide, J. W. T. Meadows, H. S. Jordan, and P. K. Lee (Los Alamos Scientific Lab., N. Mex.). Apr. 1963. Contract W-7405-eng-36. 256p.

A compilation of data documenting air and ground concentrations, particle sizes, and isotopic compositions of the radioactive effluents from the Kiwi B-1A, B-1B, and B-4A test reactors is presented. Also included is a description of the air sampling trailers especially designed to house the dynamic sampling equipment. The trailers are used to achieve a highly mobile sampling capability of any specific segment of 360° around the reactor as dictated by meteorological conditions. Data are also presented on the indirect radiation from the reactors and radiation due to passage of the effluent clouds. (auth)

35221 (MND-P-2836) SNAP 7B—STRONTIUM-90 FUELED THERMOELECTRIC GENERATOR POWER SOURCE. THIRTY-WATT U. S. COAST GUARD AUTOMATIC LIGHT STATION. Final Report. (Martin-Marietta Corp. Aerospace Div., Baltimore). June 1963. Contract AT(30-3)-217. 102p.

The objectives of the SNAP 7B program were to design, manufacture, test and deliver a thirty-watt electric generating system for a U. S. Coast Guard Automatic Light Station. This report describes the sixty-watt, strontium-90 thermoelectric generator, the converter, the batteries, and the installation of the generator into the container. The electrical tests of the generator and of the system, the shock and vibration tests, and the tests at the environmental temperature extremes are discussed. (auth)

35222 (PWA-2240) ADVANCED NUCLEAR ELECTRIC POWER GENERATOR SYSTEM STUDY. THERMIONIC NUCLEAR SPACE POWER-PLANT. Parametric Studies Report. (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). July 30, 1963. Contract NASw-360. 125p.

A 1-Mw thermionic nuclear space power plant was studied parametrically to indicate promising designs and potential problem areas. The power system was studied for a mission of 16500 hr. The evaporation rate of the nuclear fuel in space was selected as a measurable design criterion, and a system minimum weight was found at a particular cathode temperature for each evaporation rate. Minimum specific weights of 14 and 12.4 were obtained for temperatures of 3200 and 3500°F and for evaporation rates of 0.002 and 0.020 in./yr. Two reactor coolant fluids and radiator heat transfer fluids (Li and Na–K alloy) were studied, as well as two radiator materials (Be and Nb). The use of Li in both the primary and secondary loops produced the lightest power plant. Use of Na–K in both loops gave a weight penalty of

3 to 4 pounds/kw. With Li the primary loop and Na–K in the radiator system, the weight penalty was approximately half. A monolithic Nb radiator seems promising. Parametric data for major system components are included. (auth)

35223 (SY-5396-R5) SPUR POWER SYSTEM. Quarterly Progress Report for Period Ending June 30, 1963. F. B. Wallace and R. W. Heidenbrand (Garrett Corp. AiResearch Mfg. Div. of Arizona, Phoenix). July 15, 1963. Contract AF33(657)-8954. 33p.

The Phase II contract provides for continued analytical and experimental studies in support of the Space Power Unit, Reactor (SPUR) Program. Progress is reported on creep-rupture properties of molybdenum-titanium alloy, cantilever bending fatigue of niobium-zirconium alloy, mass transfer with two-phase flow, bearing tests, and properties of reactor clad and structural materials. (N.W.R.)

35224 NUCLEAR REACTOR SYSTEMS. G. Montgomery Anderson (Atomic Energy Commission, Washington, D. C.). Astronaut. Aerospace Eng., 1: No. 4, 27-36(May 1963).

The objectives of the orbital flight tests of the Snap-2 and Snap-10A are briefly outlined. Fundamental criteria for safety throughout all phases of the flight test are given. The flight design of the reactor, shield, thermoelectric generator, thermoelectric pump, and structure of the Snap-2 and -10A systems are also discussed. The performance characteristics of the Snap-2, -8, -10A are presented. (C.E.S.)

35225 ORBITAL TESTING OF SNAP SYSTEMS. George E. Austin (Air Force Systems Command, Los Angeles). Astronaut. Aerospace Eng., 1: No. 4, 37-42(May 1963).

Objectives to be accomplished in orbital testing of Snap-2 and Snap-10A are outlined. The ability of vehicle components and subsystems to survive in the radiation environment, mechanical, thermal, and electrical interface problems unique to the utilization of nuclear power, and radiological safety precautions and procedures to be established in the orbital testing of Snap systems are discussed. (C.E.S.)

35226 SPACE ELECTRICAL POWER. Walter C. Scott and Fred Schulman (National Aeronautics and Space Administration, Washington, D. C.). Astronaut. Aerospace Eng., 1: No. 4, 48-53(May 1963).

The objectives and achievements of the development program for space electrical power systems are discussed. Power requirements for various space projects and products of power development research are considered. Research on the radiation-resistant n-p solar cell, thin-film solar cells, and rechargeable batteries is outlined. The development of Snap-8 is also discussed. (C.E.S.)

35227 THERMIONIC CONVERTERS FOR SPACE POWER. Volney C. Wilson (General Electric Research Lab., Schenectady, N. Y.) and Robert C. Hamilton. Astronaut. Aerospace Eng., 1: No. 4, 62-7(May 1963).

The design and performance of thermionic converters for space power systems that utilize electric, solar, or nuclear heat sources are discussed. Cesium vapor is used as the inter-electrode medium. (C.E.S.)

35228 SPACE ISOTOPIC POWER SYSTEMS. R. T. Carpenter (Atomic Energy Commission, Washington, D. C.). Astronaut. Aerospace Eng., 1: No. 4, 68-72(May 1963).

The current status of space isotopic power systems is reviewed. Isotopic fuels technology, production, and processing, thermoelectric and thermionic power conversion technology, and aerospace nuclear safety technology are reviewed. Design and performance parameters of various Snap systems and thermoelectric and thermionic generators are presented. (C.E.S.)

35229 DYNAMIC ENERGY CONVERSION. Victor R. Kovacik (TAPCO, Cleveland). Astronaut. Aerospace Eng., 1: No. 4, 84-8(May 1963).

Closed-cycle dynamic energy conversion systems expected to be used with solar and nuclear energy sources are discussed. The demands placed on a dynamic energy conversion system by solar and nuclear energy sources that dictate different operating conditions are outlined. The Rankine cycle with working fluids of mercury, cesium, and potassium is considered. (C.E.S.)

35230 AN EVALUATION OF THE IN-RADIATOR APPROACH TO NUCLEAR-THERMIONIC SPACE POWER SYSTEMS. Donald W. Bell and Arthur I. Chalfant (United Aircraft Corp. Research Labs., East Hartford, Conn.). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-219, 19p., $1.00. (CONF-97-17)

From Summer Meeting, Los Angeles, June 1963.

The approach of mounting thermionic converters in the radiator of a nuclear-thermionic space power system was explored by evaluating the effects of several system and thermionic converter design variables on the specific weight of tubular thermionic converters and their surrounding beryllium meteoroid armor and radiation fins. Overall radiator arrangement problems were also investigated. (auth)

35231 ADVANCED 1-MEGAWATT SPACE POWER PLANT STUDY. L. Schipper, R. S. Siegler, and E. B. Zwick (Rocketdyne, Canoga Park, Calif.). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-270, 61p., $1.00. (CONF-97-8)

From Summer Meeting, Los Angeles, June 1963.

The potential of an advanced nuclear thermomechanical system was investigated. A 1-megawatt power level was chosen for this study because it is within the range of interest of the anticipated power requirements for the next decade. The study considered the effects of such advanced components as the belt radiator and the Nadyne generator. The system is a double-loop type with the primary reactor loop using lithium as the working fluid. Both potassium and rubidium were investigated as working fluids in the secondary Rankine loop. Many variations of the basic Rankine cycle were studied, including both wet and dry expansions, reheat, and superheat. Particular attention was given to exploring the broad interaction between components of the system, as well as to the weight and performance effects on key components because of changes in such prime variables as temperature, power level, and meteoroid puncture probability. Some of the dry cycles evaluated have performance capabilities equivalent to or better than the currently proposed wet cycles, even when operating between the same temperature limits. The use of a dry cycle would eliminate wet-vapor erosion in the turbine as a major problem in the development of alkali-metal turbines. Dry cycles also appear attractive when combined with the use of a belt radiator that optimizes at a lower heat-rejection temperature than a conventional radiator. The higher-cycle temperature ratios achievable can lead to substantial improvement in thermodynamic cycle efficiency and lower system weight. (auth)

35232 NUCLEAR ROCKET FLIGHT TESTING FOR OPERATIONAL MISSIONS. Herbert Radd (Lockheed Mis-

siles and Space Co., Sunnyvale, Calif.). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63083, 13p. (CONF-90-1)

From AIAA Space Flight Testing Conference, Cocoa Beach, Fla., Mar. 1963.

The first phase of nuclear rocket flight testing, designated as RIFT (Reactor-In-Flight Test), will be limited to relatively short ranges and ocean impact of the nuclear stage. Subsequent test flights will progress toward achievement of an operational flight mode; wherein the nuclear stage will be operated at near orbital, orbital, and escape velocities. This flight region is emphasized and the major problems of safety, flight sequences, and aerospace environments are considered. The nuclear hazard potential is discussed in terms of orbital and suborbital start modes and possible system countermeasures. Flight sequences are described with particular emphasis on nuclear-stage operation, and a postulated failure profile for the total launch vehicle is presented. Nuclear engine startup, full-power operation, and shutdown as functions of mission-profile are examined. Typical operational missions are described to summarize the range and nature of flight test objectives considered essential to safe and reliable operational flight. (auth)

35233 BRAYTON CYCLE NUCLEAR SPACE POWER SYSTEM AND THEIR HEAT-TRANSFER COMPONENTS. A. J. Glassman, R. P. Krebs, and T. A. Fox (Lewis Research Center, Cleveland). New York, American Inst. of Chemical Engineers, 1963, Preprint Paper 57, 29p, $0.50. (CONF-129-1)

From Heat Transfer Conference, Boston, Aug. 1963.

Several configurations being considered for Brayton cycle space power systems are described, and the required heat-transfer components are indicated. Important system characteristics such as cycle efficiency and radiator area are related to such heat-transfer-component parameters as reactor temperature, component-pressure drops, heat-exchanger effectiveness, and radiator-heat-transfer coefficient. The heat-transfer-component features necessary to make a Brayton cycle attractive for space use are emphasized, and the ability of available heat-transfer components to achieve the required performance and reliability is discussed. (auth)

35234 SIZING OF NUCLEAR ORBIT LAUNCH VEHICLES FOR INTERPLANETARY MISSIONS. John F. McLaughlin (Lockheed Missiles and Space Co., Palo Alto, Calif.). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-256, 11p. $1.00. (CONF-97-6)

From Summer Meeting, Los Angeles, June 1963.

An analysis of the sizing requirements of nuclear orbit launch boosters for interplanetary round trip flyby and stopover missions is presented. The requirements for four power levels are specified for two types of Mars lighted-side flybys for 1971, 1973, 1975, 1988, and 1990; for Venus lighted-side flybys during any conjunction period; for a two-planet flyby in 1972; and for some stopover missions. In addition, these requirements are matched with the estimated capabilities of a presently conceived operational nuclear stage and with the launching capabilities of the Saturn V. (auth)

35235 A HYPOTHETICAL FUSION PROPULSION ROCKET VEHICLE. J. L. Hilton (Aerojet-General Nucleonics, San Ramon, Calif.), J. S. Luce, and A. S. Thompson. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-239, 27p, $1.00. (CONF-97-3)

From Summer Meeting, Los Angeles, June 1963.

A preliminary engineering design of a fusion propulsion rocket is presented in detail. This type of a rocket propulsion system is designed for ignition at low earth orbit and would deliver 25-100 megawatts of continuous exhaust power for missions of several years' duration. This preliminary engineering design shows that the fusion propulsion system has many significant advantages including low fuel consumption, no critical mass or burnup problems, no closed primary power cycle, reduced radiation hazard, adjustable specific impulse, small radiator size, and high thrust to weight ratio. An arbitrary but consistent set of plasma parameters are chosen. These parameters are not optimum, but they do illustrate the range of parameter interest and show conceptual engineering feasibility of the fusion space propulsion system. The physical arrangement of the fusion propulsion system is considered. (auth)

35236 DETERMINATION OF THE RADIATION FLUX IMPINGING ON A SPACECRAFT. M. R. Morrison (Northrop Corp., Hawthorne, Calif.). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-200, 11p., $1.00. (CONF-97-15)

From Summer Meeting, Los Angeles, June 1963.

A computer code for the IBM 7090 was developed combining a two-body trajectory code and an environment code to determine the flux of electrons and protons impinging on vehicles in the Van Allen zones. The combined code, PMI Trajectory Code, uses a minimum number of simple imputs, such as latitude, longitude, altitude of perigee, inclination and eccentricity of orbits, and mission time to give as outputs, latitude, longitude, altitude of vehicle at points along the trajectory, particle fluxes at these points, and time integrated flux for total mission. (C.E.S.)

35237 CHARACTERISTICS OF NUCLEAR ROCKETS AND THE INFLUENCE OF MISSION APPLICATIONS. Herbert Radd and William H. Sterbentz (Lockheed Missiles and Space Co., Sunnyvale, Calif.). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-266, 24p., $1.00. (CONF-97-7)

From Summer Meeting, Los Angeles, June 1963.

The mission objectives, modes of operation, parametric analysis of operation characteristics, and special mission and design problems for nuclear rockets are presented. The Saturn V launch vehicle with a nuclear-powered third stage is used as a basis for the analysis. The nuclear third stage is treated as a variable both in terms of thrust and liquid hydrogen capacity. The nuclear engine considered has a solid core reactor, transferring heat directly to the hydrogen propellant. (C.E.S.)

35238 ELECTRICAL PROPULSION TESTING RESEARCH AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER. Andrew E. Lennert (ARO, Inc., Arnold Air Force Station, Tenn.). New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-240, 21p., $1.00. (CONF-97-4)

From Summer Meeting, Los Angeles, June 1963.

A research program conducted at Arnold Engineering Development Center on extended testing of ion propulsion systems is discussed, and results of sputtering research are presented that indicate that present collector systems are unsuitable for extended lifetime tests. A facility capable of simulating launch trajectories and providing transient data are described. (auth)

WASTE DISPOSAL AND PROCESSING

35239 (DPSPU-63-30-4B) MEASUREMENT OF RADIOIODINE IN PUREX STACK GASES. W. R. Jacobsen and L. Jolly, Jr. (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.). May 1963. Contract AT(07-2)-1. 17p. (CONF-67-22)

From Health Physics Society 8th Annual Meeting, New York, June 1963.

The chemical behavior of iodine-131 in stack air from this site's Purex process is reported. The radioiodine in the stack gases apparently consists of variable proportions of molecular vapor and other forms of iodine, thus causing the efficiencies for most collection media to vary widely. Activated charcoal is a satisfactory collection medium although Process gases (ammonia and oxides of nitrogen) lower the efficiency of the charcoal from 99 to 88%. Ambient temperature and humidity had no effect on deposition and retention of iodine in long stainless steel sampling lines. Process conditions did have an effect and estimates of iodine released were 10 to 15% low due to this line loss. (auth)

35240 (EUR-262.e) THE DECONTAMINATION OF SYNTHETIC EFFLUENT BY FLOTATION. R. Lopes Cardozo (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 14p.

It is shown that flotation, both of sludges and of ions, may present a useful way for the decontamination of radioactive effluent. Decontamination factors of more than 25 for Cs, of more than 200 for Eu, and of about 1.5 for Sr were obtained. The volume of the foamate, after foam desintegration, was about 0.01% of the volume of the treated water. (auth)

35241 (HW-69426) PROPOSED DISPOSAL TO GROUND OF NPR DECONTAMINATION WASTES AT AN INLAND SITE. Randall E. Brown (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 13, 1961. Contract AT(45-1)-1350. 9p.

Geologic and hydrologic studies were made to select a site for disposal of phosphoric acid decontamination wastes from the NPR primary coolant loop. It is concluded that wastes discharged to ground at a crib site at coordinates N64,000 and W49,500 will flow with the ground waters into the Columbia River downstream from the 100-F Area. However, the crib site is less ideal because of short travel times to Columbia River. (D.L.C.)

35242 (HW-71929) PROPOSAL FOR FINAL DISPOSAL OF NPR CHEMICAL WASTE. W. D. Bainard (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 5, 1961. Contract AT(45-1)-1350. 14p.

The chemical decontamination of the NPR primary cooling system will produce large volumes of waste solutions which must be disposed of. The decontamination procedures are described in some detail. Possible disposal methods are discussed, and it is proposed that the wastes be pumped to a covered crib after precipitation treatment. The design of the waste storage facility is described. (D.L.C.)

35243 (HW-77080) PILOT PLANT DENITRATION OF PUREX WASTE WITH SUGAR. E. A. Coppinger (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 29, 1963. Contract AT(45-1)-1350. 16p.

Batch denitration of synthetic Purex waste was investigated in 12 batch runs in the pilot plant denitration unit. Sugar was continuously added to 25 liters of hot waste. After sugar addition was complete, the hot solution was digested for several hours. The reaction proceeded smoothly and was easily controlled. About 19 to 22 moles of nitric acid were destroyed per mole of sugar with a reaction pot temperature of 100°C and a digestion period of 12 hours. About 17 moles of nitric acid were destroyed per mole of sugar when the reaction pot temperature was reduced to 95°C. A possible plant flowsheet for batch denitration with sugar was developed. This flowsheet presumes batch denitration of large 2,500-gallon batches of waste in a standard 5,000-gallon Purex Plant tank and incorporates 12 hours of sugar addition and 12 hours of digestion. The flowsheet was successfully demonstrated in the pilot plant equipment. A 1.4M sugar solution was added to 25 liters of hot (100°C) waste for 12 hours and the mixture was digested for 18 hours. The initial nitric acid concentration was 6.14M. The residual nitric acid concentration was 0.94 and 0.90M after 12 and 18 hours of digestion, respectively. A residual carbon content equivalent to 1.9 and 0.4% of the total carbon fed as sugar was present after 12 and 18 hours of digestion, respectively. About 19 moles of nitric acid were destroyed per mole of sugar fed. Foaming was produced during batch denitration with sugar by addition of 0.4 gram of dibutyl phosphate per liter of synthetic waste. The addition of 0.2 gram of Dow-Corning Antifoam B per liter of waste reduced foam levels by about a factor of two. An induction period of about six to nine minutes was observed before the reaction started. The length of the induction period increased as initial sugar addition rates were reduced. Gentle air sparging reduced the induction period by about a factor of two. Attempts to use sodium nitrite as a means of decreasing the induction period were not successful. Sugar solution was added to cold waste, and the mixture was heated to determine the pot pressures and tower pressure drops that could be developed under abnormal conditions. A decrease in pot vacuum of 30 in. of water and a tower pressure drop of 8 in. of water were observed when 20 liters of waste and 2.7 liters of 2.5M sugar solution were mixed together and rapidly heated to 100°C. (auth)

35244 (HW-SA-2982) SOLVENT EXTRACTION PROCESS FOR RECOVERY OF STRONTIUM, RARE EARTHS AND CESIUM FROM RADIOACTIVE WASTE SOLUTIONS. L. A. Bray (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 17, 1963. Contract AT(45-1)-1350. 13p. (CONF-157-2)

From American Chemical Society, Northwest Regional Meeting, Bellingham, Wash., June 1963.

A new solvent extraction process was developed for the simultaneous extraction of Cs, Sr, and the rare earths from acidic wastes. In this process, designated as CSREX, a mixture of di-2-ethylhexylphosphoric acid (D2EHPA) and 4-sec-butyl-2-(α-methylbenzyl) phenol (BAMBP) in a kerosene-type diluent is used as the organic solvent. D2EHPA has a synergistic effect on the extractive properties of BAMBP, broadening the effective extraction pH range for Cs to a range of 3 to 14. Data are presented for the distribution of Cs, Sr, Ce, and Na as a function of D2EHPA and BAMBP concentrations and of phenol extractant. (D.L.C.)

35245 (NP-12997) REPORT ON SHIPPING CONTAINERS AND CASKS FOR RADIOACTIVE WASTE MATERIALS. (New York Central Railroad Co., New York). Apr. 1960. 28p.

The exterior construction and design features of twelve

different shipping containers and casks are evaluated in terms of their provisions for handling ease and safety. Suggested methods for fastening them to gondola or flat cars are illustrated. (D.C.W.)

35246 ON THE DECONTAMINATION OF RADIOACTIVE WASTE WATER BY FERRIC HYDROXIDE FLOCCULATION. [PART] I. Takashi Matsumura, Toshio Ishiyama, and Tetsuo Mamuro. Ann. Rept. Radiation Center Osaka Prefect., 3: 32-6(1962). (In English)

The decontamination properties of ferric hydroxide flocculation were investigated in the case that only very small amounts of foreign matter are present in the water to be decontaminated. The pH value of the reacting medium was found to have a serious effect on the decontamination. The main decontamination process is completed when the ferric hydroxide particles are formed in the reacting medium. Stirring after this stage produced no further improvement in decontamination. No noticeable difference was found between the flocculations in a beaker and in a flocculator under the same conditions. (P.C.H.)

35247 STUDY ON THE DEWATERING TREATMENT OF RADIOACTIVE SLUDGES. Toshio Ishiyama, Takashi Matsumura, and Tetsuo Mamuro. Ann. Rept. Radiation Center Osaka Prefect., 3: 37-43(1962). (In English)

A comparison was made of the effects of polymer addition on volume reduction of sludges by settling, filtration, centrifuging, and freezing. An advantage was found in polymer addition in the freezing technique. The most effective dewatering method for bentonite-Konan Floc, calcium phosphate, and ferric hydroxide sludges is summarized. Vacuum filtration after freezing and thawing was considered to be the most effective method. (P.C.H.)

35248 A RADIOACTIVE SLUDGE CONCENTRATOR. Tetsuo Mamuro, Takashi Matsumura, and Toshio Ishiyama. Ann. Rept. Radiation Center Osaka Prefect., 3: 44-6(1962). (In English)

The design and operation of a radioactive waste concentrator is presented. Flow sheets of the concentrator and flocculator systems are also illustrated. The concentrator is composed of two retention tanks, a head tank, two flocculators, two sludge tanks, a sand filter, a vermiculite column, two monitoring tanks, and the sludge concentrator. (P.C.H.)

35249 FILTER BLOWBACK SYSTEM (Engineering Materials). (Argonne National Lab., Ill.). (CAPE-787)

This package contains 11 drawings. The filter blowback system is used in calcining radioactive waste through the use of fluidized bed techniques by converting liquid wastes to solids. Liquid wastes are spray-injected into the heated bed where water and nitrates are removed by evaporation and thermal decomposition. Granular and free flowing product is continuously removed through an outlet pipe. The stainless-steel equipment is installed in concrete walls. The calciner is constructed of 6 in. pipe and is externally heated by mounted electrical heaters. Periodically, heated blowback air is provided to clean the filters and return the fines into the bed to serve as seed nuclei. Ruthenium decontamination factors of 2×10^4 at 400°C and 8×10^4 at 500°C, and non-volatile factors of 10^5 were obtained. (F.E.S.)

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Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

ä	becomes	ae
ö		oe
ø		oe
ü		ue (except in transliterated Chinese names)

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As an aid to the users of this index, references to report numbers, where appropriate, are included after the abstract number of the citation.

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Betatron Construction and Utilization, Bucharest, Nov. 1962, 17: 34999 (NP-13064)
Dynamics of Manned Lifting Planetary Entry, Philadelphia, Penna., Oct. 1962, 17: 33438
Effects of Pre-sowing Irradiation of Seeds in Agricultural Crops, Moscow, Feb. 1961, 17: 34202
Eighth Annual AEC and Contractor Nuclear Materials Management Symposium, Chicago, Oct. 3 to 5, 1962, 17: 33417 (TID-7660)
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Engineering for Major Scientific Programs, Atlanta, Ga., Feb. 1963, 17: 34081
Geometry Programs for Heavy Liquid Bubble Chambers, CERN, May 21, 1963, 17: 34223 (CERN-63-23)
Neutron Dosimetry, Harwell, England, Dec. 1962. Vol. 1, 17: 34266
Ninth National Analysis Instrumentation Symposium, Houston, Texas, April 1963, 17: 33842
Nondestructive Testing of Aircraft and Missile Components, San Antonio, Texas, Feb.–Mar. 1962, 17: 34114
Programming and Utilization of Research Reactors, Vienna, Oct. 1961, 17: 35178
Radiation Damage in Solids and Reactor Materials, Venice, May 7–11, 1962, 17: 34512
Radioecology, Fort Collins, Colo., 1961, 17: 33539
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2	17-33849	ORINS. British Convention on Electronics and Productivity, Southampton, Eng., Apr. 1963
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57	17-35066	ORINS. Gmelin, AED-CONF-63-060-80
59	17-34533	Dep.(mc); $3.60(fs), $1.31(mf) OTS; Gmelin, AED-CONF-63-060-75
60	17-34478	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-060-76
61	17-35063	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-060-78
63	17-34829	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-060-59
64	17-34319	Dep.(mc); $4.60(fs), $1.70(mf) OTS; Gmelin, AED-CONF-63-060-61
65	17-34830	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-060-64
66	17-35083	$1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-060-56
67	17-34479	Dep.(mc); $2.60(fs), $1.10(mf) OTS; Gmelin, AED-CONF-63-060-55
68	17-34831	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-060-54
69	17-34717	Dep.(mc); $2.60(fs), $0.92(mf) OTS; Gmelin, AED-CONF-63-060-71
70	17-35084	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-060-72
71	17-34832	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-060-70
72	17-35215	ORINS. Gmelin, AED-CONF-63-060-74
73	17-34871	ORINS. Gmelin, AED-CONF-63-060-73
74	17-35119	ORINS. Gmelin, AED-CONF-63-060-69
75	17-33851	ORINS. Gmelin, AED-CONF-63-060-57
77	17-34986	ORINS. Gmelin, AED-CONF-63-060-58
78	17-35067	ORINS. Gmelin, AED-CONF-63-060-81
81	17-33852	ORINS. Gmelin, AED-CONF-63-060-68
82	17-34987	ORINS. Gmelin, AED-CONF-63-060-65
83	17-34192	ORINS. Gmelin, AED-CONF-63-060-62
84	17-35166	ORINS. Gmelin, AED-CONF-63-060-63
85	17-34870	ORINS. Gmelin, AED-CONF-63-060-60
CONF-46–	**(American Physical Society Meeting, Washington, D. C., Apr. 1963)**	
49	17-34985	ORINS. Gmelin, AED-CONF-63-048-50
54	17-34983	ORINS. Gmelin, AED-CONF-63-048-42
62	17-34653	ORINS. Gmelin, AED-CONF-63-048-89
77	17-35057	ORINS. Gmelin, AED-CONF-63-048-85
84	17-34534	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-048-96
85	17-34990	ORINS. Gmelin, AED-CONF-63-048-105
86	17-34722	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-048-100
87	17-35022	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-048-98
89	17-34988	ORINS. Gmelin, AED-CONF-63-048-99
90	17-34824	ORINS. Gmelin, AED-CONF-63-048-102
91	17-34825	ORINS. Gmelin, AED-CONF-63-048-101
92	17-34991	ORINS. Gmelin, AED-CONF-63-048-94
CONF-50–	**(American Ceramic Society Annual Meeting, Pittsburgh, Apr.-May 1963)**	
1	17-34365	See LADC-5598
16	17-34323	See HW-SA-3014
CONF-53–	**(1962 World Metal Show, New York, New York, Oct. 29–Nov. 2, 1962)**	
3	17-34471	ORINS
4	17-34470	ORINS
CONF-57–	**(Electron Beam Symposium, Boston, Mar. 1963)**	
6	17-34656	ORINS. Gmelin, AED-CONF-63-031-12
CONF-58–	**(Institute of Electrical and Electronics Engineers International Convention, New York, Mar. 1963)**	
3	17-34519	ORINS. Gmelin, AED-CONF-63-034-4
CONF-59–	**(ASM Western Metal Congress, Los Angeles, Mar. 1963)**	
4	17-34416	See UCRL-7326(Rev.I)
CONF-62–	**(3rd Conference on Reactions Between Complex Nuclei, Asilomar, Calif., Apr. 1963)**	
14	17-34982	ORINS. Gmelin, AED-CONF-63-054-12
CONF-63–	**(American Physical Society Meeting, Seattle, Aug. 1962)**	
4	17-34480	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-62-149-116
CONF-66–	**(Symposium on the Biology of Radioiodine, Richland, Wash., June 1963)**	
2	17-34151	See LADC-5515
5	17-34144	$2.60(fs), $0.95(mf) OTS; Gmelin, AED-CONF-63-063-6
6	17-34145	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-063-7
CONF-67–	**(Health Physics Society Annual Meeting, New York, New York, June 1963)**	
11	17-34189	ORINS. Gmelin, AED-CONF-63-049-6
18	17-34146	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-049-8
20	17-34147	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-049-21
21	17-34140	ORINS. Gmelin, AED-CONF-63-049-30
22	17-35239	See DPSPU-63-30-4B
26	17-34148	$1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-049-31
27	17-33779	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-049-28
28	17-34658	ORINS. Gmelin, AED-CONF-63-049-25
CONF-68–	**(Electrochemical Society, Pittsburgh, Apr. 1963)**	
3	17-34469	ORINS. Gmelin, AED-CONF-63-064-2
CONF-69–	**(Conference on Operating Experience with Power Reactors, Vienna, June 1963)**	
7	17-34084	ORINS
10	17-35164	ORINS. Vienna, International Atomic Energy Agency, 1963, Preprint CN-15/5
11	17-35165	ORINS. Vienna, International Atomic Energy Agency, 1963, Preprint CN-15/3
CONF-71–	**(Gaseous Electronics Conference, Boulder, Colo.,**	

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	Oct. 1962)	
2	17-35062	ORINS. Gmelin, AED-CONF-62-186-22
CONF-73–	**(Sixth Biennial Conference on Carbon, Univ. of Pittsburgh, June 1963)**	
7	17-33860	See BNL-6638
8	17-34473	ORINS. Gmelin, AED-CONF-63-061-15
9	17-34474	ORINS. Gmelin, AED-CONF-63-061-14
10	17-34475	ORINS. Gmelin, AED-CONF-63-061-11
11	17-34485	See HW-SA-2924
CONF-74–	**(ASTM Conference on Mass Spectrometry and Allied Topics, San Francisco, May 1963)**	
11	17-33850	ORINS. Gmelin, AED-CONF-63-050-21
12	17-34204	ORINS
13	17-33950	ORINS. Gmelin, AED-CONF-63-050-32
14	17-33944	ORINS. Gmelin, AED-CONF-63-050-30
15	17-33945	ORINS. Gmelin, AED-CONF-63-050-31
20	17-34651	ORINS. Gmelin, AED-CONF-63-050-36
CONF-76–	**(Symposium on Molecular Structure and Spectroscopy, Columbus, Ohio, June 1963)**	
6	17-33951	ORINS. Gmelin, AED-CONF-63-074-6
CONF-77–	**(Symposium on Plasma Space Science, Washington, D. C., June 1963)**	
7	17-34696	ORINS. Gmelin, AED-CONF-63-051-6
8	17-34697	ORINS. Gmelin, AED-CONF-63-051-8
CONF-78–	**(American Physical Society Meeting, Buffalo, June 1963)**	
4	17-34535	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-090-11
5	17-34064	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-090-10
6	17-35023	Dep.(mc); $2.60(fs), $1.01(mf) OTS; Gmelin, AED-CONF-63-090-8
8	17-34659	ORINS
9	17-35061	ORINS. Gmelin, AED-CONF-63-090-12
10	17-35056	ORINS. Gmelin, AED-CONF-63-090-19
CONF-80–	**(Inst. of Nuclear Materials Management Annual Meeting, Buffalo, June 1963)**	
3	17-33442	ORINS. Inst. of Nuclear Materials Management Meeting, Buffalo, June 1963
4	17-34106	Dep.(mc); $2.60(fs), $0.98(mf) OTS; Gmelin, AED-CONF-63-071-5
5	17-35167	ORINS. Gmelin, AED-CONF-63-071-4
CONF-81–	**(Conference on Basic Mechanisms in the Radiation Chemistry of Aqueous Media, Gatlinburg, Tenn., May 1963)**	
3	17-33966	See BNL-7045
CONF-84–	**(American Industrial Health Conference, Cincinnati, May 1963)**	
2	17-34149	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-057-2
CONF-87–	**(Symposium on Hypervelocity Techniques, Denver, Mar. 1962)**	
1	17-35059	ORINS. Gmelin, AED-CONF-62-031-2
CONF-89–	**(International Symposium on Humidity and Moisture, Washington, D. C., May 1963)**	
2	17-34206	ORINS. Gmelin, AED-CONF-63-068-4
5	17-34205	ORINS. Gmelin, AED-CONF-63-068-2
CONF-90–	**(AIAA Space Flight Testing Conference, Cocoa Beach, Fla., Mar. 1963)**	
1	17-35232	ORINS. AED-CONF-63-089-1. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63083
CONF-91–	**(6th National Instrumentation Symposium, Philadelphia, May 1963)**	
2	17-34216	ORINS. Gmelin, AED-CONF-63-088-3
CONF-94–	**(American Nuclear Society Meeting, Nuclear Materials for Space Applications, Cincinnati, Apr. 1963)**	
4	17-34399	Dep.(mc); $2.60(fs), $0.89(mf) OTS; Gmelin, AED-CONF-63-067-8
5	17-34360	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-067-2
CONF-95–	**(American Nuclear Society Symposium on Space Simulation, Vacuum, Temperature, Radiation, New York, May 1963)**	
1	17-34085	ORINS. Gmelin, AED-CONF-63-066-2
CONF-97–	**(Summer Meeting, Los Angeles, June 1963)**	
2	17-34103	ORINS. Summer Meeting, Los Angeles, June 1963
3	17-35235	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-239, $1.00
4	17-35238	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-240, $1.00
5	17-34086	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-243, $1.00
6	17-35234	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-256, $1.00
7	17-35237	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-266, $1.00
8	17-35231	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-270, $1.00
10	17-34652	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-158, $1.00
12	17-35058	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-161, $1.00
15	17-35236	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-200, $1.00
17	17-35230	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-219, $1.00
20	17-34105	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-202, $1.00
22	17-34654	ORINS. New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-157, $1.00
CONF-98–	**(Conference on Nuclear Energy, Public Policy and the Law, New York, May 1963)**	
1	17-34191	ORINS. Gmelin, AED-CONF-63-065-2
2	17-34190	ORINS. Gmelin, AED-CONF-63-065-1
CONF-99–	**(American Inst. of Chemical Engineers Meeting, New Orleans, Mar. 1963)**	
1	17-35060	ORINS. Gmelin, AED-CONF-63-017-6
CONF-102–	**(Winter Meeting of ASME, Philadelphia, Pennsylvania, Nov. 1963)**	
3	17-34417	See UCRL-7430
4	17-34331	See WAPD-T-1605

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CONF-105–		**(AEC Metallography Meeting, Los Alamos, N. Mex., May 1963)**
1	17-34364	See LADC-5851
CONF-107–		**(American Nuclear Society Materials Symposium, San Diego, Calif., Apr. 1962)**
1	17-35219	See LADC-5261
CONF-112–		**(National Convention on Nondestructive Testing, Los Angeles, Mar. 1963)**
3	17-34107	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-035-2
CONF-114–		**(International Conference on High Energy Accelerators, Dubna, Aug. 1963)**
5	17-35002	See UCRL-10900
CONF-118–		**(Robert A. Welsh Foundation Conference, Houston, Tex., Nov. 1962)**
1	17-33874	See UCRL-10619
CONF-119–		**(Air Pollution Control Ass'n. Meeting, Detroit, June 1963)**
1	17-34142	See BNL-7022
CONF-120–		**(Conference on New Nuclear Materials Technology, Including Non-Metallic Fuel Elements, Prague, July 1963)**
25	17-34343	ORINS. Vienna, International Atomic Energy Agency, 1963, Preprint CN-16/60
28	17-34521	ORINS
CONF-122–		**(International Conference on Nucleon Structure, Stanford Univ., June 1963)**
2	17-34821	ORINS. Gmelin, AED-CONF-63-101-11
5	17-34827	ORINS. Gmelin, AED-CONF-63-101-5
6	17-34820	ORINS. Gmelin, AED-CONF-63-101-8
7	17-34822	ORINS. Gmelin, AED-CONF-63-101-6
10	17-34819	ORINS. Gmelin, AED-CONF-63-101-10
CONF-123–		**(8th Annual Uranium and Minerals Symposium, Riverton, Wyoming, June 1963)**
1	17-34116	Dep.(mc); $4.60(fs), $1.70(mf) OTS; Gmelin, AED-CONF-63-059-1
CONF-126–		**(Conference on Noble Gas Compounds, Argonne, Ill., April 1963)**
1	17-33863	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-085-1
2	17-33948	ORINS. Gmelin, AED-CONF-63-085-6
3	17-33947	ORINS. Gmelin, AED-CONF-63-085-3
7	17-33864	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-085-5
8	17-34481	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-085-10
9	17-33865	Dep.(mc); $2.60(fs), $0.86(mf) OTS; Gmelin, AED-CONF-63-025-37
10	17-33866	Dep.(mc); $2.60(fs), $0.83(mf) OTS; Gmelin, AED-CONF-63-085-4
13	17-33946	ORINS. Gmelin, AED-CONF-63-085-11
CONF-127–		**(MPIF-ASM Powder Metallurgy Symposium National Metals Congress, New York, October-November 1962)**
1	17-34361	Dep.(mc); $2.60(fs), $0.86(mf) OTS
CONF-129–		**(Heat Transfer Conference, Boston, Aug. 1963)**
1	17-35233	ORINS. New York, American Inst. of Chemical Engineers, 1963, Preprint 57, $0.50
4	17-34104	ORINS. New York, American Inst. of Chemical Engineers, 1963, Preprint 57, $0.50
CONF-131–		**(Topical Conference on Recently Discovered Resonant Particles, Athens, Ohio, Apr. 1963)**
1	17-34724	See EFINS-63-33
CONF-133–		**(IAEA Symposium of Exponential and Critical Experiments with Calculations, Amsterdam, Sept. 1963)**
1	17-34718	Dep.(mc); $7.60(fs), $2.45(mf) OTS
CONF-137–		**(Eastern Conference of Radiology, New York, March 1962)**
1	17-33616	See NYO-10350
CONF-139–		**(Third Symposium on Reactor Theory, Bad Nauheim, Ger., Apr. 1963)**
1	17-35116	ORINS
CONF-140–		**(Nuclear Energy Conference, Milan, Dec. 1961)**
1	17-33853	ORINS
CONF-150–		**(Congress of Science on Humans, 2nd Annual Conference, New York, June 1963)**
1	17-33757	See BNL-7145
CONF-151–		**(19th International Union of Pure and Applied Chemistry Congress, London)**
1	17-33777	See BNL-7146
2	17-33867	Dep.(mc); $7.60(fs), $2.39(mf) OTS
CONF-154–		**(4th International Congress of Rheology, Providence, R. I., Aug. 1963)**
1	17-33868	Dep.(mc); $1.10(fs), $0.80(mf) OTS
CONF-155–		**(American Chemical Society Southeastern Regional Meeting, Charlotte, N. C., Nov. 1963)**
1	17-34400	Dep.(mc); $1.10(fs), $0.80(mf) OTS
CONF-156–		**(Symposium on Reactor Kinetics and Control, Tucson, Ariz., Mar. 1963)**
1	17-35108	See WAPD-T-1601
CONF-157–		**(American Chemical Society Northwest Regional Meeting, Bellingham, Wash., June 1963)**
1	17-34050	See HW-SA-3082
2	17-35244	See HW-SA-2982
3	17-34537	See HW-SA-2893A(Rev.)
CONF-160–		**(Annual Atomic Energy Commission Contractors Meeting, Nuclear Materials Management, Idaho Falls, Idaho, Oct. 1963)**
1	17-34314	Dep.(mc); $1.60(fs), $0.80(mf) OTS
CONF-163–		**(1963 National Telemetering Conference, Albuquerque, N. Mex., May 1963)**
1	17-34522	ORINS. Gmelin, AED-CONF-63-102-1
CONF-164–		**(Society of Nuclear Medicine 10th Annual Meeting, Montreal, June 1963)**
3	17-34193	ORINS. Gmelin, AED-CONF-63-100-4
5	17-34194	ORINS. Gmelin, AED-CONF-63-100-3
6	17-33508	ORINS. Gmelin, AED-CONF-63-100-2
CONF-165–		**(1963 Joint Automatic Control Conference, Minneapolis, June 1963)**
1	17-34089	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-091-2
CONF-166–		**(American Society for Testing Materials 66th Annual Meeting, Atlantic City, June 1963)**
5	17-34524	ORINS. Gmelin, AED-CONF-63-098-8
6	17-34525	ORINS. Gmelin, AED-CONF-63-098-6
7	17-34523	ORINS. Gmelin, AED-CONF-63-098-7

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8	17-34108	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-098-4
9	17-34482	Dep.(mc); $3.60(fs), $1.31(mf) OTS; Gmelin, AED-CONF-63-098-5
CRDC–	**(Canadian)**	
1157	17-33780	Dep.; $0.50(AECL)
CRE–	**(Canadian)**	
1155	17-35170	Dep.; $0.50(AECL)
CREL–	**(Canadian)**	
1123	17-34315	Dep.; $1.00(AECL)
CRRD–	**(Canadian)**	
1110	17-34150	Dep.; $0.50(AECL)
CVNA–	**(Misc.)**	
147	17-35085	Dep.(mc); $11.00(fs), $4.52(mf) OTS
DLCS–		
3410204	17-35138	Dep.(mc); $1.10(fs), $0.80(mf) OTS
5000663	17-35139	Dep.(mc); $3.60(fs), $1.40(mf) OTS
DMIC–	**(Non-AEC)**	
184	17-34320	$1.50(OTS) as AD-413567
DOFL-TR–	**(Non-AEC)**	
1148	17-34833	
DP–		
798	17-33781	Dep.; $0.75(OTS)
808	17-34048	Dep.; $0.50(OTS)
826	17-34049	Dep.; $0.50(OTS)
831	17-33782	Dep.; $2.50(OTS)
832	17-35086	Dep.; $0.75(OTS)
833	17-35087	Dep.; $1.50(OTS)
DPSPU–		
63-30-4B	17-35239	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-049-20
DRI–	**(Misc.)**	
2112	17-34401	Dep.(mc); $1.60(fs), $0.80(mf) OTS
DUBNA REPORTS	**(Russian)**	
See JINR (Russian)		
EFINS–	**(Misc.)**	
63-21	17-34875	Dep.(mc); $2.60(fs), $0.86(mf) OTS
63-24	17-35075	Phys. Rev., 131: 2373-80(1963)
63-25	17-34723	Dep.(mc); $1.60(fs), $0.80(mf) OTS
63-30	17-34788	Phys. Rev. Letters, 11: 90-3(1963)
63-33	17-34724	Dep.(mc); $3.60(fs), $1.16(mf) OTS
63-42	17-34773	Phys. Letters, 5: 355-6(1963)
63-43	17-34618	Phys. Rev. Letters, 11: 119-21(1963)
63-47	17-34772	Phys. Letters, 5: 353-5(1963)
EUR–	**(European Atomic Energy Community)**	
143.f	17-33630	Ann. Amelioration Plantes, 12: 93-115 (1962)
147.f	17-33479	Dep.(mc)
164.d	17-34434	Ber. Deut. Keram. Ges., 40: 136-9(1963)
221.e	17-35088	Dep.(mc)
224.i	17-33789	Dep.(mc)
262.e	17-35240	Dep.(mc)
270.e	17-33790	Dep.(mc)
283.i	17-35089	Dep.(mc)
292.i	17-34834	Dep.(mc)
293.e	17-34090	Dep.(mc)
294.i	17-33530	Dep.(mc)
300.f	17-34235	Dep.(mc)
305.e	17-35090	Dep.(mc)
306.i	17-33853	See CONF-140-1
315.e	17-34210	J. Appl. Phys., 33: 2474-8(1962)
317.e	17-34588	Nature, 194: 1167(1962)
324.f	17-33956	Bull. Soc. Chim. Belges, 72: 50-9(1963)
338.e	17-34536	Dep.(mc)
340.f	17-34483	Dep.(mc); see also CONF-120-28
342.i	17-34835	Dep.(mc)
348.d	17-34091	Dep.(mc)
350.i	17-34836	Dep.(mc)
351.i	17-34837	Dep.(mc)
357.d	17-34402	Dep.(mc)
358.i	17-34838	Dep.(mc)
360.i	17-35091	Dep.(mc)
362.f	17-34207	Dep.(mc)
367.e	17-34839	Dep.(mc)
EURAEC–		
299	17-34092	Dep.(mc); $1.60(fs), $0.80(mf) OTS
604	17-34346	See GEAP-4211
612	17-35092	Dep.(mc); $1.60(fs), $0.80(mf) OTS
620	17-34403	See GEAP-4192
622	17-35093	Dep.(mc); $1.60(fs), $0.80(mf) OTS
634	17-34052	Dep.(mc); $5.60(fs), $1.88(mf) OTS
655	17-34333	Dep.(mc); $1.60(fs), $0.80(mf) OTS
656	17-34484	Dep.(mc); $1.60(fs), $0.80(mf) OTS
658	17-34093	Dep.(mc); $3.60(fs), $1.34(mf) OTS
701	17-34362	Dep.(mc); $2.60(fs), $0.98(mf) OTS
702	17-35094	Dep.(mc); $7.60(fs), $2.48(mf) OTS
796	17-34111	See SWRI-1296-6-2
801	17-34401	See DRI-2112
802	17-34872	See BAW-1281
805	17-34347	See IITRI-B198-43
FN-E–	**(Italian)**	
32	17-34484	See EURAEC-656
33	17-34093	See EURAEC-658
34	17-34362	See EURAEC-701
35	17-35094	See EURAEC-702
FTD-TT–	**(Non-AEC)**	
63-351	17-34564	OTS
FZM–	**(Non-AEC)**	
2937	17-34518	See CONF-1-20
2944	17-34306	See CONF-39-20
GA–	**(Misc.)**	
4121	17-34523	See CONF-166-7
GEAP–	**(Misc.)**	
4140	17-35095	Dep.; $1.00(OTS)
4141	17-35096	Dep.; $1.25(OTS)
4192	17-34403	Dep.; $0.75(OTS)
4193(Pt.I)	17-34094	Dep.; $1.00(OTS)
4206	17-34321	Dep.; $1.00(OTS)
4211	17-34346	Dep.; $1.25(OTS)
4214	17-35097	Dep.; $1.75(OTS)
4215	17-35140	Dep.; $1.50(OTS)
4257	17-34363	Dep.; $0.50(OTS)
4258	17-34095	Dep.(mc); $2.60(fs), $0.98(mf) OTS
4278	17-33765	Dep.(mc); $2.60(fs), $1.07(mf) OTS
4304	17-35098	Dep.(mc); $6.60(fs), $2.15(mf) OTS
GEMP–		
232	17-35141	Dep.(mc); $1.60(fs), $0.80(mf) OTS
GNEC–		
210(Suppl.3)	17-35142	Dep.(mc); $6.60(fs), $2.07(mf) OTS
288	17-35099	Dep.(mc); $8.60(fs), $2.99(mf) OTS

Report No.	Abstract No.	Availability
HEPL–	**(Misc.)**	
264*	17-34876	
HW–		
68600-29	17-34322	Dep.; $0.50(OTS)
69426	17-35241	Dep.(mc); $1.10(fs), $0.80(mf) OTS
70178	17-34096	Dep.(mc); $3.60(fs), $1.13(mf) OTS
71929	17-35242	Dep.(mc); $1.60(fs), $0.80(mf) OTS
74625	17-34109	Dep.; $1.00(OTS)
77080	17-35243	Dep.(mc); $1.60(fs), $0.80(mf) OTS
77303	17-34097	Dep.; $1.75(OTS)
77538	17-33791	Dep.; $0.50(OTS)
77950	17-33766	Dep.(mc); $1.10(fs), $0.80(mf) OTS
HW-SA–		
2259	17-33614	p.615-18 of "Radioecology", New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963
2271(Rev.)	17-33611	p.581-601 of "Radioecology", New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963
2310	17-33595	p.451-3 of "Radioecology", New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963
2316	17-33545	p.35-8 of "Radioecology", New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963
2447	17-33606	p.539-56 of "Radioecology", New York, Reinhold Publishing Corporation and Washington, D. C., The American Institute of Biological Sciences, 1963
2509	17-33509	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2893A(Rev.)	17-34537	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-096-1
2924	17-34485	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-061-13
2982	17-35244	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-096-3
3014	17-34323	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-046-16
3082	17-34050	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-096-2
HWS–		
5936	17-34370	See TID-19154
5937(Rev.1)	17-34371	See TID-19155
5938(Rev.3)	17-34372	See TID-19156
8225(Rev.5)	17-34374	See TID-19158
8227(Rev.2)	17-34375	See TID-19159
8240(Rev.3)	17-34373	See TID-19157
8241(Rev.4)	17-34376	See TID-19160
IA–	**(Non-AEC)**	
810	17-33767	Dep.(mc)
IDO–		
14609	17-33792	Dep.; $1.25(OTS)
16869	17-35143	Dep.; $1.75(OTS)
16887	17-34324	Dep.; $1.00(OTS)
IFA-IS–	**(Rumanian)**	
20	17-33869	Dep.(mc)
IITRI–	**(Misc.)**	
B198-43	17-34347	Dep.(mc); $4.60(fs), $1.49(mf) OTS
B6005-8	17-34404	Dep.(mc); $1.60(fs), $0.80(mf) OTS
IS–		
576	17-34405	Dep.; $0.50(OTS)
621	17-33870	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-040-8
653	17-34592	Phys. Letters, 5: 234-5(1963)
ISS–	**(Italian)**	
63/27	17-34725	Dep.(mc)
63/34	17-34726	Dep.(mc)
JINR–	**(Russian)**	
E-1275	17-35068	Dep.(mc)
E-1294	17-34727	Dep.(mc)
P-1242	17-34728	Dep.(mc)
P-1269	17-34729	Dep.(mc)
P-1277	17-34877	Dep.(mc)
P-1290	17-34730	Dep.(mc)
P-1326	17-34661	Dep.(mc)
JLI–		
2748-0-7	17-34195	Dep.; $10.10(fs), $3.83(mf) OTS
JPRS–	**(Non-AEC)**	
20379	17-33621	$0.50(OTS)
20425	17-33622	$0.50(OTS)
K–		
1573	17-34043	Dep.; $0.75(OTS)
1580	17-34309	Dep.; $2.60(fs), $0.86(mf) OTS
KD–		
1766	17-34720	See TID-19011
LA–		
2234(Del.)	17-34878	Dep.(mc); $4.60(fs), $1.49(mf) OTS
2235	17-34879	Dep.(mc); $1.60(fs), $0.80(mf) OTS
LADC–		
3284	17-34868	p.2185-2226 of "Fast Neutron Physics. Part II", New York, Interscience Publishers, 1963
5106	17-34387	See TID-14525
5261	17-35219	Dep.(mc); $2.60(fs), $0.83(mf) OTS
5473	17-34608	Phys. Rev., 131: 2101-7(1963)
5515	17-34151	$2.60(fs), $0.95(mf) OTS; Gmelin, AED-CONF-63-063-4
5518	17-35050	Phys. Rev., 131: 1891-7(1963)
5598	17-34365	Dep.(mc); $2.60(fs), $0.86(mf) OTS; Gmelin, AED-CONF-63-046-9
5736	17-34064	See CONF-78-5
5741	17-34607	Phys. Rev., 131: 2098-2100(1963)
5762	17-33810	Anal. Chem., 35: 1502-5(1963)
5851	17-34364	Dep.(mc); $1.10(fs), $0.80(mf) OTS
LAMS–		
2917	17-34366	Dep.; $0.75(OTS)
2920	17-35100	Dep.; $1.75(OTS)
2932	17-35220	Dep.; $3.50(OTS)
2949	17-34325	Dep.; $0.50(OTS)
LM-TAB–	**(Non-AEC)**	
22	17-34326	
MATT–		
151	17-35024	Dep.; $2.75(OTS)
180	17-35025	Dep.; $2.25(OTS)
188	17-34606	Phys. Rev., 131: 2041-5(1963)
MITNE–	**(Misc.)**	
35	17-35101	Dep.(mc); $6.60(fs), $2.09(mf) OTS

Report No.	Abstract No.	Availability
MLM–		
1146	17-33412	Dep.; $2.60(fs), $0.92(mf) OTS
1159	17-34196	Dep.; $0.50(OTS)
MND-M–	**(Misc.)**	
2935(Vol.I)	17-35144	Dep.; $0.75(OTS)
MND-MD–		
2560-9	17-35145	Dep.(mc); $9.10(fs), $3.32(mf) OTS
2957	17-35146	Dep.; $2.75(OTS)
MND-P–		
2836	17-35221	Dep.; $2.50(OTS)
MSAR–	**(Misc.)**	
63-117	17-34406	Dep.(mc); $2.60(fs), $0.89(mf) OTS
MURA–	**(Misc.)**	
673	17-34997	Dep.; $0.50(OTS)
NAA-SR–		
6761	17-34407	Dep.; $0.75(OTS)
7475	17-35147	Dep.; $0.50(OTS)
7921	17-34408	Dep.; $0.50(OTS)
8056	17-34327	Dep.; $0.50(OTS)
8224	17-35148	Dep.; $2.00(OTS)
8225	17-35102	Dep.; $0.50(OTS)
NAA-SR-Memo–		
2658	17-35103	Dep.(mc); $1.10(fs), $0.80(mf) OTS
3034	17-35104	Dep.(mc); $3.60(fs), $1.19(mf) OTS
NASA-TN–	**(Misc.)**	
D-1742*	17-34098	
NASA-TT–	**(Non-AEC)**	
F-153	17-35069	$0.75(OTS)
NMI–	**(Misc.)**	
1253	17-34409	Dep.; $1.75(OTS)
7009	17-34486	Dep.(mc); $5.60(fs), $1.91(mf) OTS
NMI-TJ–		
51	17-34470	See CONF-53-4
NP–	**(AEC File No. for Non-AEC Reports)**	
1146S(Pt.II)	17-33967	$5.00(BIS); 25s. (HMSO)
12328(Rev.)	17-34117	
12662	17-34840	$1.60(OTS) as AD-407333
12967	17-33413	
12991	17-34328	
12997	17-35245	
13002	17-34998	Dep.(mc)
13008	17-33414	Dep.(mc)
13010	17-33480	
13011	17-34487	
13014	17-34488	
13017	17-33871	Dep.(mc)
13018	17-34880	Dep.(mc)
13027	17-34367	
13028	17-34208	Dep.(mc)
13029	17-35149	Dep.(mc)
13030	17-34110	Dep.(mc)
13031	17-34489	
13032	17-34490	
13037	17-34538	
13044	17-34539	
13045	17-34368	
13050	17-34881	
13051	17-34882	
13057	17-34410	
13058	17-34540	
13059	17-35026	
13063	17-34541	
13064	17-34999	Dep.(mc)
NP-R–	**(British)**	
206	17-34112	See TRG-Report-170
NPCC-MWP–	**(British)**	
(S)/P.219	17-34112	See TRG-Report-170
(S)/P(63)35	17-34113	See TRG-Report-576
NYO–		
10178	17-33968	Dep.; $2.00(OTS)
10209	17-35101	See MITNE-35
10273	17-34699	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10274	17-34731	Dep.(mc); $2.60(fs), $1.04(mf) OTS
10276	17-34732	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10277	17-34733	Dep.(mc); $3.60(fs), $1.22(mf) OTS
10278	17-34734	Dep.(mc); $4.60(fs), $1.46(mf) OTS
10350	17-33616	$1.10(fs), $0.80(mf) OTS
ORNL–		
2536	17-35150	Dep.(mc); $8.60(fs), $3.02(mf) OTS
3131	17-34348	Dep.; $2.75(OTS)
3391	17-33872	Dep.; $1.50(OTS)
3455	17-34883	Dep.; $2.50(OTS)
3480	17-34542	Dep.; $2.75(OTS)
ORNL-TM–		
483	17-34411	Dep.(mc); $11.00(fs), $4.67(mf) OTS
541	17-33768	Dep.(mc); $8.10(fs), $2.72(mf) OTS
598	17-33769	Dep.(mc); $2.60(fs), $0.98(mf) OTS
602	17-34099	Dep.(mc); $2.60(fs), $0.83(mf) OTS
617	17-34065	Dep.(mc); $3.60(fs), $1.37(mf) OTS
622	17-34349	Dep.(mc); $3.60(fs), $1.28(mf) OTS
640	17-33617	Dep.(mc); $1.60(fs), $0.80(mf) OTS
641	17-34412	Dep.(mc); $1.60(fs), $0.80(mf) OTS
ORO–		
589	17-34236	Dep.; $0.50(OTS)
606	17-35151	Dep.; $2.50(OTS)
OTS–	**(Misc.)**	
63-31396*	17-33621	See JPRS-20379
63-31422*	17-33622	See JPRS-20425
PA-TR–	**(Non-AEC)**	
3078	17-33969	$2.60(OTS)
PAEC(D)PH–	**(Philippines)**	
633	17-35171	Dep.(mc)
635	17-34735	Dep.(mc)
PATENTS	**(German)**	
1,147,328	17-34307	
1,148,336	17-34308	
1,148,663	17-34391	
1,149,466	17-35120	
1,149,761	17-34217	
1,149,830	17-35121	
1,149,831	17-35122	
1,149,909	17-34357	
1,150,764	17-35168	
1,150,765	17-35123	
1,151,073	17-35124	
1,151,607	17-35125	
1,151,608	17-35126	
PATENTS	**(U. S.)**	**$0.25 each, U. S. Patent Office**
3,099,525	17-34046	

Report No.	Abstract No.	Availability
3,099,537	17-33854	
3,099,555	17-34047	
3,099,611	17-34527	
3,099,613	17-34042	
3,099,616	17-35127	
3,099,743	17-33855	
3,099,745	17-34218	
3,099,768	17-34219	
PB–	**(Non-AEC)**	
171980	17-33770	Dep.(mc); $1.75(OTS)
PG-Report–	**(British)**	
441	17-33793	Dep.
442	17-33794	Dep.(mc)
449	17-33795	Dep.
462	17-33796	Dep.
469	17-33797	Dep.
475	17-33798	Dep.
476	17-33799	Dep.
477	17-33800	Dep.
PNE–	**(Misc.)**	
112F(Pt.I)	17-34118	Dep.; $1.25(OTS)
221F	17-34066	Dep.; $1.00(OTS)
230F*	17-34067	Dep.; $1.25(OTS)
300	17-34068	Dep.; $0.50(OTS)
PPAD–		
487F	17-34736	Dep.(mc); $9.60(fs), $3.53(mf) OTS
PRDC-TR–		
70	17-35152	Dep.(mc); $1.60(fs), $0.80(mf) OTS
PRWRA-GNEC–		
5(Add.3)	17-35153	Dep.(mc); $11.00(fs), $4.55(mf) OTS
PWA–	**(Non-AEC)**	
2240	17-35222	
Q–	**(Misc.)**	
B2089-2*	17-34318	See AD-413120
R–	**(Misc.)**	
63SD60*	17-35027	
RBESO–	**(Non-AEC)**	
3404-3	17-34369	$4.60(OTS)
REIC–	**(Non-AEC)**	
27	17-34491	
28	17-34492	
RFP–		
325	17-34719	Dep.(mc); $1.10(fs), $0.80(mf) OTS
RISÖ–	**(Danish)**	
53	17-34558	Dep.(mc)
56	17-35172	Dep.(mc)
60	17-34237	Dep.(mc)
RM–	**(Misc.)**	
3696-PR*	17-35028	$2.60(OTS)
3748-PR*	17-34559	$4.60(OTS)
RRL–		
110	17-34646	Z. Naturforsch., 18a: 753-61(1963)
RT-FI–	**(Italian)**	
(63)25	17-34238	Dep.(mc)
SC–	**(Misc.)**	
4774(RR)	17-34152	Dep.; $0.50(OTS)
4911(RR)	17-35029	Dep.; $1.25(OTS)
4922(RR)	17-34069	Dep.; $0.75(OTS)
4926(RR)	17-34153	Dep.; $0.50(OTS)
SCPRI(RM)–	**(French)**	
VI-1963	17-34154	Dep.(mc)
SLAC–		
10	17-35000	Dep.; $2.00(OTS)
SRO–		
92	17-35154	Dep.(mc); $1.10(fs), $0.80(mf) OTS
STI-PUB–	**(International Atomic Energy Agency)**	
56(Vol.III)	17-34512	$4.00; Sch 84; 24s.stg; NF 16; DM14 (IAEA)
69(Vol.I)	17-34266	$13.00; 273s; NF 52; DM 45.50(IAEA)
STL–	**(Misc.)**	
6303	17-35105	Dep.(mc); $2.60(fs), $0.83(mf) OTS
SWRI–		
1296-6-2	17-34111	Dep.(mc); $6.60(fs), $2.06(mf) OTS
SY–	**(Misc.)**	
5396-R5*	17-35223	
TEI–		
812	17-34138	Geological Survey Professional Paper 386-C. 1963. 25p. (GPO)
TID–		
3043(Rev.2) (Suppl.1)	17-33415	Dep.; $2.00(OTS)
3525(Rev.5)	17-35106	Dep.; $2.50(OTS)
3552(Rev.2)	17-34155	Dep.; $0.50(OTS)
3575	17-33801	Dep.; $0.75(OTS)
3715	17-33416	Dep.; Free (DTI Extension)
4100(1st Rev.) (Suppl.17)	17-34070	Dep.; Free (DTI Extension)
7660	17-33417	Dep.; $3.00(OTS)
14146	17-34329	Dep.(mc); $5.60(fs), $1.94(mf) OTS
14525	17-34387	Plating, 50: 215-20(1963)
15249	17-34115	p.119-28 of "Proceedings of the Third Annual Symposium on Nondestructive Testing of Aircraft and Missile Components, February 27, 28, March 1, 1962, San Antonio, Texas"
16148	17-33448	See ANL-6723(p.33-40)
16155	17-33456	See ANL-6723(p.73-81)
16454	17-34428	Advan. X-Ray Anal., 6: 142-57(1963)
17223	17-33771	Dep.; $2.25(OTS)
17469	17-34038	Talanta, 10: 737-44(1963)
17549	17-34919	Nucl. Phys., 46: 66-72(1963)
17557	17-33618	Dep.; $1.00(OTS)
17602	17-33735	Radiation Res., 19: 628-35(1963)
17885	17-35155	Dep.; $1.50(OTS)
18014	17-34134	Science, 139: 407-8(1963)
18351	17-33906	J. Chem. Phys., 39: 283-5(1963)
18365	17-33905	J. Chem. Phys., 39: 275-83(1963)
18651	17-33809	Anal. Chem., 35: 1436-8(1963)
18692	17-34777	Phys. Rev., 131: 2208-18(1963)
18892	17-34156	Dep.; $1.50(OTS)
18898	17-34051	Dep.; $2.00(OTS)
18990	17-33510	Dep.(mc); $4.60(fs), $1.46(mf) OTS
19011	17-34720	Dep.(mc); $1.60(fs), $0.80(mf) OTS
19046	17-34874	See CONF-13-7
19047	17-34884	Dep.(mc); $2.60(fs), $0.89(mf) OTS; Gmelin, AED-CONF-63-013-21

Report No.	Abstract No.	Availability
19056	17-35173	Dep.(mc); $9.60(fs), $3.65(mf) OTS
19085	17-33970	Dep.(mc); $3.60(fs), $1.40(mf) OTS
19109	17-34413	Dep.(mc); $1.60(fs), $0.80(mf) OTS
19142	17-34737	Dep.(mc); $3.60(fs), $1.25(mf) OTS
19143	17-33511	Dep.(mc); $2.60(fs), $1.01(mf) OTS
19153	17-33619	Dep.(mc); $1.10(fs), $0.80(mf) OTS
19154	17-34370	Dep.(mc); $1.10(fs), $0.80(mf) OTS
19155	17-34371	Dep.(mc); $1.10(fs), $0.80(mf) OTS
19156	17-34372	Dep.(mc); $1.10(fs), $0.80(mf) OTS
19157	17-34373	Dep.(mc); $1.10(fs), $0.80(mf) OTS
19158	17-34374	Dep.(mc); $1.60(fs), $0.80(mf) OTS
19159	17-34375	Dep.(mc); $5.60(fs), $1.94(mf) OTS
19160	17-34376	Dep.(mc); $1.10(fs), $0.80(mf) OTS
19176	17-34885	Dep.(mc); $2.60(fs), $0.95(mf) OTS
19195	17-34560	Dep.(mc); $7.60(fs), $2.57(mf) OTS
19207	17-33437	Dep.
19219	17-33971	Dep.(mc); $1.10(fs), $0.80(mf) OTS
19229	17-34414	Dep.(mc); $1.10(fs), $0.80(mf) OTS
19236	17-33873	Dep.(mc); $2.60(fs), $1.04(mf) OTS
19249	17-34100	$1.60(fs), $0.80(mf) OTS
19258	17-33952	Dep.(mc); $3.60(fs), $1.16(mf) OTS
19259	17-33953	Dep.(mc); $1.10(fs), $0.80(mf) OTS
19265	17-33954	Dep.(mc); $1.60(fs), $0.80(mf) OTS
19268	17-34377	Dep.(mc); $1.10(fs), $0.80(mf) OTS
TIM–	**(Misc.)**	
711	17-33802	Dep.(mc); $1.60(fs), $0.80(mf) OTS
TM–	**(Misc.)**	
63-2-8	17-33861	See CONF-20-18
63-4-12	17-34399	See CONF-94-4
63-6-3	17-34398	See CONF-39-43
63-6-4	17-34479	See CONF-39-67
63-6-5	17-34534	See CONF-46-84
63-6-6	17-33862	See CONF-39-50
63-6-700	17-35137	See CONF-39-48
TRG-Report–	**(Non-AEC)**	
170	17-34112	Dep.; $0.42(BIS); 3s. (HMSO)
576	17-34113	Dep.; $0.25(BIS); 1s. 9d. (HMSO)
TT–	**(Canadian)**	
1080	17-34700	Dep.(mc); $1.60(fs), $0.80(mf) JCL
UAC–		
6458	17-33456	See ANL-6723(p.73-81)
6475	17-33448	See ANL-6723(p.33-40)
6973	17-33735	See TID-17602
7234	17-33906	See TID-18351
7235	17-33905	See TID-18365
UCRL–		
6187(Rev.)	17-34415	Dep.(mc); $6.60(fs), $2.12(mf) OTS
7275	17-35052	Phys. Rev., 131: 2129-30(1963)
7326(Rev.I)	17-34416	Dep.(mc); $2.60(fs), $1.07(mf) OTS
7430	17-34417	Dep.(mc); $2.60(fs), $1.01(mf) OTS
10342(Rev.)	17-34953	Phys. Rev., 131: 2169-75(1963)
10361	17-34297	p.535-45 of "Neutron Dosimetry. Vol. I." Vienna, IAEA, 1963
10542	17-34781	Phys. Rev., 131: 2248-81(1963)
10562(Rev.)	17-35074	Phys. Rev., 131: 2345-9(1963)
10619	17-33874	$7.60(fs), $2.36(mf) OTS
10761	17-34767	See UCRL-10761(Rev.)
10761(Rev.)	17-34767	Phys. Letters, 5: 283-6(1963)
10770	17-34239	Dep.; $2.25(OTS)
10779	17-34738	Dep.; $1.75(OTS)
10783	17-34886	Dep.; $2.75(OTS)
10797(Rev.)	17-34766	Phys. Letters, 5: 279-82(1963)
10807	17-35001	Dep.; $4.00(OTS)
10816	17-34418	Dep.; $1.50(OTS)
10838	17-34739	Dep.; $1.00(OTS)
10865	17-34887	Dep.; $2.75(OTS)
10872	17-34888	Dep.; $2.00(OTS)
10900	17-35002	Dep.(mc); $1.10(fs), $0.80(mf) OTS
UCRL-Trans–		
969	17-34334	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
984	17-34241	Dep.(mc); $3.60(fs), $1.22(mf) JCL
UR–		
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